# Sisquoc System
# Water Master Plan

## Golden State Water Company

December 2019

# Executive Summary

## Purpose

The purpose of this Master Plan is to assess Golden State Water Company's (GSWC) Sisquoc System's ability to meet current and future water needs, and to identify upgrades needed if deficiencies exist. This assessment is developed by using hydraulic analysis criteria, future demands and available supply, water quality standards, and condition of facilities.

These updates provide GSWC with a basis to determine the impacts of new development on the existing system and to identify system deficiencies and improvements needed to correct them. These system improvement needs are used as the basis for developing the Capital Improvement Program (CIP) for the system. TABLE 9-1 summarizes the CIP projects identified in this master plan.

GSWC's goal is to meet the minimum requirements identified in the technical memorandum titled *Golden State Water Company Master Planning Criteria and Standards* (see Appendices).

## Master Plan Process

This master plan document is organized as follows:

- Update existing system information
- Establish existing demands and forecast future demands
- Update system's hydraulic model
- Evaluate supply and storage capacities
- Perform hydraulic analyses and evaluation
- Identify water quality issues
- Assess condition of facilities in the system
- Develop CIP

# Contents

## Appendices (provided on CD)



# Tables

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# Acronyms and Abbreviations

| | |
|---|---|
| 1,1-DCE | 1,1-dichloroethylene |
| 2016 WMP | Sisquoc 2016 Water Master Plan |
| AACE International | Association for the Advancement of Cost Engineering International |
| ADD | average day demand |
| AFY | acre-feet per year |
| amsl | above mean sea level |
| AOB | ammonia-oxidizing bacteria |
| CIP | capital improvement program |
| CPUC | California Public Utilities Commission |
| DDW | State Water Resources Control Board, Division of Drinking Water |
| DPB Rule | Disinfectants and Disinfection Byproducts Rule |
| DWR | California Department of Water Resources |
| EPA | U.S. Environmental Protection Agency |
| FCV | flow-control valve |
| fps | foot or feet per second |
| GAC | granular activated carbon |
| gpm | gallons per minute |
| GSWC | Golden State Water Company |
| GWO | General Work Order |
| HPC | heterotrophic plate count |
| IDSE | Initial Distribution System Evaluation |
| MCL | maximum contaminant level |
| MDD | maximum day demand |
| MG | million gallons |
| MHD | minimum hour demand |
| NAICS | North American Industry Classification System |
| NOB | nitrite-oxidizing bacteria |

| | |
|---|---|
| O&M | operations and maintenance |
| PCE | tetrachloroethylene |
| PHD | peak hour demand |
| PRV | pressure-regulating valve |
| psi | pounds per square inch |
| PSV | pressure-sustaining valve |
| SCADA | supervisory control and data acquisition |
| SDWA | Safe Drinking Water Act |
| TDS | total dissolved solids |
| TTHM | total trihalomethanes |
| VOC | volatile organic compound |
| WMP | Water Master Plan |

SECTION 1

# Introduction

## 1.1 Overview of Golden State Water Company

GSWC is a subsidiary of American States Water Company, an investor-owned utility dedicated to increasing value through the expert management of utility assets and services. As a public utility, GSWC is committed to the purchase, production, distribution, and sale of water to over 260,000 customer connections.

GSWC is organized into three regions throughout the state of California. Region I is located in northern and central coast of California. Region II serves communities in Los Angeles County. Region III serves communities in Los Angeles, San Bernardino, Imperial, and Orange counties.

FIGURE 1-1, provided at the end of this section, shows the locations of all GSWC water systems.

## 1.2 Master Plan Update

The purpose of this master plan is to assess the Sisquoc System's ability to meet current and future water needs and recommend system upgrades needed to meet current customer needs. This assessment is developed by using hydraulic design criteria, water quality standards, system demands and available supply, and facility condition assessments.

Specifically, this master plan supports GSWC's effort to update existing master plans and hydraulic models for water systems throughout the company. These updates provide GSWC with a baseline for determining the impacts of new development on existing systems as well as identifying short, mid, and long term system needs. These system needs are used as the basis for developing the capital improvement program (CIP) for the system. The primary drivers of this master plan update are the following:

- Assess the distribution system's hydraulic performance
- Identify infrastructure that is in poor condition and needs to be replaced
- Identify supply and storage needs
- Identify water quality and treatment needs
- Provide documentation for the proposed CIP projects in support of the General Rate Case for the California Public Utilities Commission (CPUC)
- Reduce operations and maintenance (O&M) efforts and costs required to maintain service under current conditions
- Minimize service failures

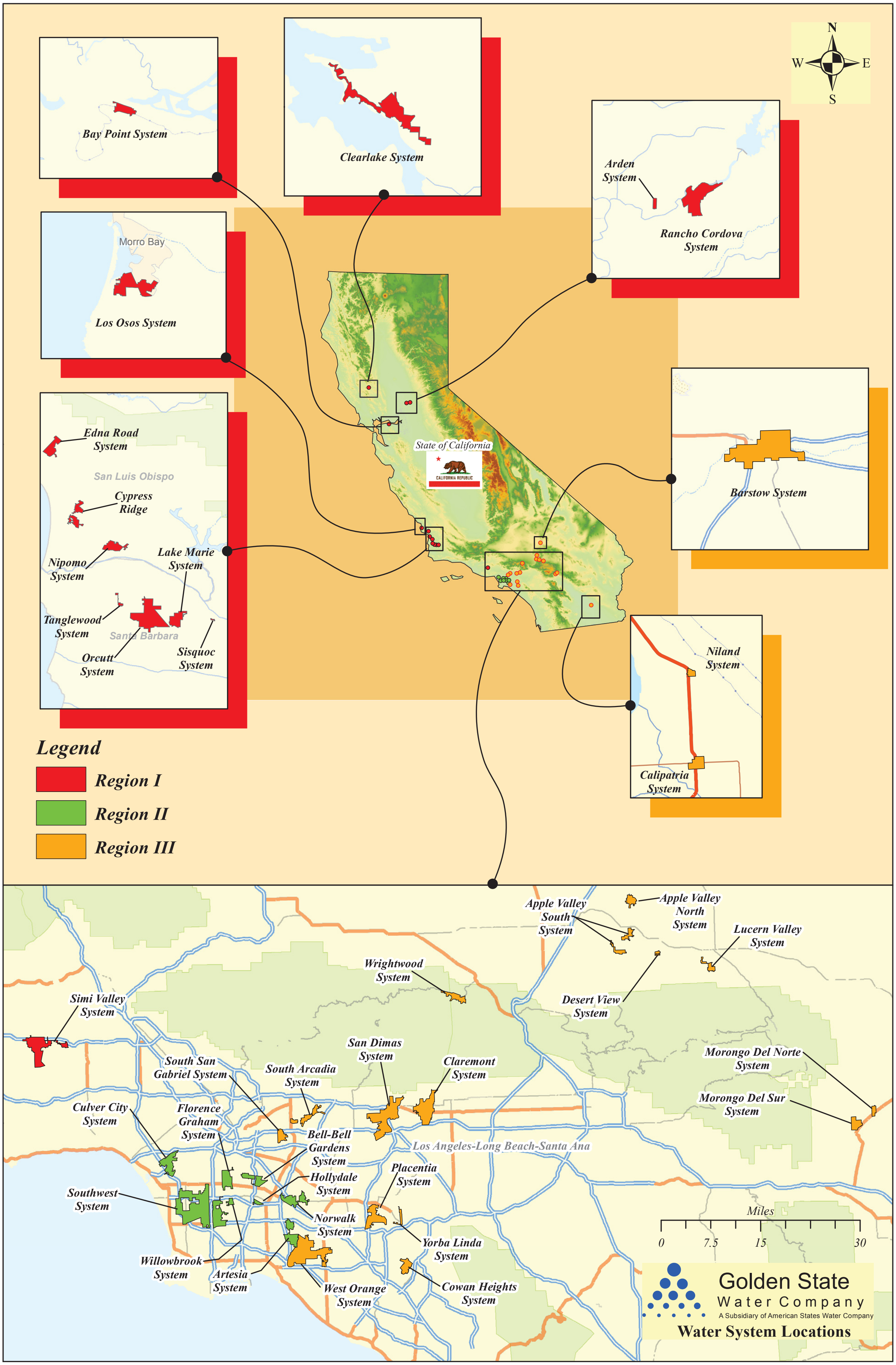
## 1.3 Document Organization

This master plan document is organized to provide information in a sequential manner that considers historical progression (past to present to future) and logical evaluation of the system from existing facilities and requirements through future needs. Each section's title and a brief summary are as follows:

1. **Introduction:** Provides background information on the company and its systems.
2. **Existing Water System Facilities:** Provides an overview of the system and its facilities. System facilities identified include the system service area boundary, pressure zones, distribution areas, supply sources, storage facilities, pump stations, pressure regulating and water control stations, and transmission and distribution pipelines.
3. **Existing and Future Demands:** Provides definition of demand types and periods, as well as existing and future demands. Explains the demand development approach and determination of peaking factors. Provides the current demands and projected demands developed for a future 2040 condition. Future demands are based on population growth rate and water use projections.
4. **Hydraulic Model Development and Calibration:** Provides an overview of the modeling process, including hydraulic model construction and calibration.
5. **Supply and Storage Capacity Evaluation:** Documents the evaluation of the system's water supply and storage capacity using the objectives identified in GSWC's *Master Planning Criteria and Standards.* The evaluation results establish supply and storage needs for each distribution area and the entire distribution system. Existing and future supply and storage deficiencies are also identified. Recommended improvements to mitigate deficiencies are also provided.
6. **Hydraulic Analysis and Evaluation:** Outlines the approach for the hydraulic analysis. Details how the updated hydraulic model was used to determine hydraulic deficiencies under simulated demand scenarios and was compared with the analysis and planning criteria for short, mid, and long term planning periods. Provides recommendations to address deficiencies that were identified. Scenarios simulated by the hydraulic model include average day, maximum day, and peak hour conditions.
7. **Water Quality Analysis:** Provides GSWC's evaluation of water quality based on current and pending federal and state standards and rules.
8. **System Condition Assessment:** Provides GSWC's documentation of system condition assessment efforts including past efforts, recent field inspections, and recommendations for future improvements.
9. **Capital Improvement Program:** Describes the CIP plan resulting from all preceding tasks broken down into short, mid, and long term planning periods. This includes prioritization and justification for the projects included in the CIP.
10. **References:** Lists the primary sources of information referred to throughout the master plan.

Appendices provide supporting information on various specifications and details referred to throughout the master plan.

# Figures




GSWC Engineering Planning October 2017

SECTION 2

# Existing Water System Facilities

This section documents existing water system facilities for the Sisquoc System. Detailed information about the major facilities, such as water supply facilities, storage facilities, pipelines, pumping facilities, and regulating valves serves as the basis for subsequent system analysis throughout the master plan. This section begins with an overview of the system, and then presents detailed information about these facilities.

## 2.1 Overview

The Sisquoc System covers approximately 0.08 square miles and serves an unincorporated area of Santa Barbara County.

The System obtains its water supply from local groundwater wells in the Santa Maria Basin. The system is relatively small, consisting primarily of residential customers along with a school and a fire department.

The Sisquoc System has a network of 1.4 miles of pipe ranging in diameter from 4 to 8 inches.

## 2.2 Facility Descriptions

The major system facilities are shown in FIGURE 2-1 at the end of this Section. These facilities are discussed in detail in the following subsections:

- Pressure zones
- Supply sources
- Storage facilities
- Pumping stations
- Pressure regulating stations and flow control stations
- Transmission and distribution pipelines

### 2.2.1 Pressure and Distribution Zones

The Sisquoc System is comprised of one pressure zone. TABLE 2-1 provides details of the pressure zone and lists the PRVs and/or booster stations within the zone. FIGURE 2-2 presents the system's hydraulic profile (schematic of the water system).

TABLE 2-1 Pressure Zone Details

| Pressure Zone | HGL (ft msl) | Elevations Served (ft msl) | Supply and Storage Facilities* | | |
|---|---|---|---|---|---|
| | | | Storage Tanks | Wells and Purchased Water | PRV/Booster Station |
| Main Zone | 540 | 420-440 | Sisqouc Reservoirs and Foxen Canyon Tanks | Foxen Canyon Wells #4 & #5 | Foxen Canyon Booster |

* Does not include hydropneumatic tanks or emergency interconnections.

## 2.2.2 Supply Sources

GSWC currently obtains its water supply for the Sisquoc System from one primary source: GSWC owned and operated groundwater wells.

### Groundwater

The system has two active wells; their locations are identified in FIGURE 2-1.

### Active Wells

Two groundwater wells were identified as active for this master plan. TABLE 2-2 presents the relevant data for these wells. The elevation shown for each well is the elevation of the wellhead facilities. The pumping water level is the depth measured from the wellhead to the surface of the groundwater while the well pump is running. Pumping water levels were based on recent levels monitored and recorded by GSWC. The groundwater elevation was calculated by subtracting the pumping water level from the wellhead elevation. Well capacities are based on facility design capacities, which may vary slightly with recent pump test data. Total dynamic head (TDH) represents the amount of energy required by the pump to produce water at the given flow rate. The discharge location describes where the well pump discharges.

TABLE 2-2 Active Wells

| Well | Discharge Location | Wellhead Elevation (ft msl) | Pumping Water Level (ft) | Pumping Groundwater Elevation (ft msl) | TDH[a] (ft) | Capacity[b] (gpm) |
|---|---|---|---|---|---|---|
| Foxen Canyon #4 | Main Zone | 435 | 221 | 214 | 315 | 100 |
| Foxen Canyon #5 | Main Zone | 446 | 180 | 266 | 280 | 100 |
| **Total groundwater production capacity** | | | | | | **200** |

msl: above mean sea level

[a] TDH is based on pump design point data.
[b] Capacity is based on facility design capacity, under normal operating conditions, and may not reflect actual capacity at a given point in time.

### Non-operational Wells

The system has no non-operational wells.

TABLE 2-3 Non-Operational Wells

| Well | Discharge Location | Elevation (ft msl) | Previous Capacity (gpm) | Reason |
|---|---|---|---|---|
| - | - | - | - | - |

### Purchased Water

The Sisquoc System does not have any purchased water supply connections.

TABLE 2-4 Imported Water Supply Connections

| Imported Water Supply Connection | Hydraulic Grade Line (ft) | Capacity (gpm) | Pressure Setting at Connection (psi) | Ground Surface Elevation (ft msl) | Imported Water Supply Pipeline |
|---|---|---|---|---|---|
| - | - | - | - | - | - |

### Emergency Interconnections

The Sisquoc System does not have any emergency interconnections.

TABLE 2-5 Emergency Interconnections

| Interconnection Name/Location | Capacity* (gpm) | Notes |
|---|---|---|
| - | - | - |

* Capacity of an emergency interconnection is not considered a reliable supply; rather, it is considered an "interruptible" supply, as it is based on whether or not the neighboring water agency has available water.

## 2.2.3 Storage Facilities

Water distribution systems rely on stored water to help equalize fluctuations between supply and demand, to supply sufficient water for firefighting, and to meet demands during an emergency or an unplanned outage of a major supply source. This section describes the existing storage facilities in the system.

### Storage Tanks

The Sisquoc System has four storage tanks. A summary of the reservoirs is provided in TABLE 2-6.

TABLE 2-6 Storage Tanks

| Tank | Type and Zone | Bottom of Tank (ft msl) | High Water Elevation (ft msl) | Tank Height (ft) | Diameter (ft) | Volume (MG) |
|---|---|---|---|---|---|---|
| Sisquoc Reservoir #1 | Main Zone | 540 | 552 | 12 | 12 | 0.01 |
| Sisquoc Reservoir #2 | Main Zone | 540 | 552 | 12 | 12 | 0.01 |
| Foxen Canyon Tank #1[a] | Main Zone | 435 | 447 | 13 | 8 | 0.005 |
| Foxen Canyon Tank #2[a] | Main Zone | 435 | 447 | 13 | 8 | 0.005 |
| **Total systemwide storage capacity** | | | | | | **0.03** |

[a] For emergency purposes only, can be filled with imported (i.e. trucked-in) water; maintained by Operations on a regular basis so that if/when needed these tanks will be available and not require disinfection.

## 2.2.4 Pumping Stations

Pumping stations are required to convey water from ground-level tanks into the distribution system or from lower-pressure zones into higher-pressure zones (usually called booster pumping stations). Pumping stations may consist of one or more individual pumps. Multiple pumps at each station, or multiple pumping stations that serve the same pressure zone, help to increase water system reliability by ensuring that water can still be delivered into that zone if one pump is out of service. Critical pumping stations may be equipped with emergency power supplies in case of failure of the primary power source.

The Sisquoc System has one booster pump, located at the Foxen Canyon Well #4 site. This booster pump is for emergency purposes only; it must be manually activated to operate if Foxen Canyon Tanks #1 & #2 are filled with imported (i.e. trucked-in) water. TABLE 2-7 presents pump data relevant to the water system analysis.

TABLE 2-7 Booster Pumps

| Facility | Pressure Zone | | Backup Power Available | Elevation (ft msl) | TDH (ft) | Capacity (gpm) |
|---|---|---|---|---|---|---|
| | Suction | Discharge | | | | |
| Foxen Canyon Booster A | Foxen Canyon Tanks | Main Zone | None | 435 | - | - |

msl: above mean sea level

## 2.2.5 Pressure Regulating and Flow Control Stations

Pressure regulating and flow control stations allow distribution systems to transfer water from higher pressure zones to lower pressure zones without exceeding the allowable pressures in the lower zones or completely depressurizing the higher zone. The water is transferred through a valve that reduces the pressure or controls the flow rate to a specified setting. Regulating valves can operate based on one or more controlling parameters. The operational controls important to this analysis include pressure reducing, pressure sustaining, pressure relief, and flow rate:

- **Pressure reducing valve:** modulates to maintain a preset minimum downstream pressure setting; if the downstream pressure drops, then the valve will open until the downstream pressure matches the pressure setting.
- **Pressure sustaining valve:** modulates to maintain a preset minimum upstream pressure setting; if the upstream pressure drops, then the valve will close until the upstream pressure matches the pressure setting.
- **Pressure relief valve:** opens when the upstream pressure exceeds a preset maximum pressure setting.
- **Flow control valve:** modulates to maintain a preset flow rate through the valve regardless of pressure.

There are no hydraulically-operated valves in the Sisquoc System. TABLE 2-8 lists the relevant data for these valves.

TABLE 2-8 Pressure Regulating and Flow Control Valves

| Name/Location | Pressure Zone | | Type | Dia. (in) | Setting (psi) | Maximum Capacity (gpm) |
|---|---|---|---|---|---|---|
| | Upstream | Downstream | | | | |
| - | - | - | - | - | - | - |

### 2.2.6 Transmission and Distribution Pipelines

The Sisquoc System has a total of 1.4 miles of pipe ranging in diameter from 4 to 8 inches. TABLE 2-9 lists the estimated footage of pipelines by diameter and material.

TABLE 2-9 Pipes by Size and Material

| Diameter (in) | Length of Pipe by Material (ft) | | | | Total Length (ft) |
|---|---|---|---|---|---|
| | AC | DI | PVC | STL | |
| 4 | 310 | 72 | - | - | 382 |
| 6 | - | - | 210 | 84 | 294 |
| 8 | - | 4,612 | 2,208 | - | 6,820 |
| **Totals (ft)** | 310 | 4,684 | 2,418 | 84 | **7,496** |
| **Totals (mi)** | 0.1 | 0.9 | 0.5 | 0.02 | **1.4** |
| **Percent (%)** | 4.1 | 62.5 | 32.3 | 1.1 | **100.0** |

AC: asbestos cement or transite
DI: ductile iron
PVC: polyvinyl chloride
STL: steel

TABLE 2-10TABLE 2-10 Pipes by Size and Year Built

| Diameter (in) | Length of Pipe by Material (ft) | | Total Length (ft) |
|---|---|---|---|
| | 1980-1999 | 2000-2019 | |
| 4 | 310 | 72 | 382 |
| 6 | 294 | 0 | 294 |

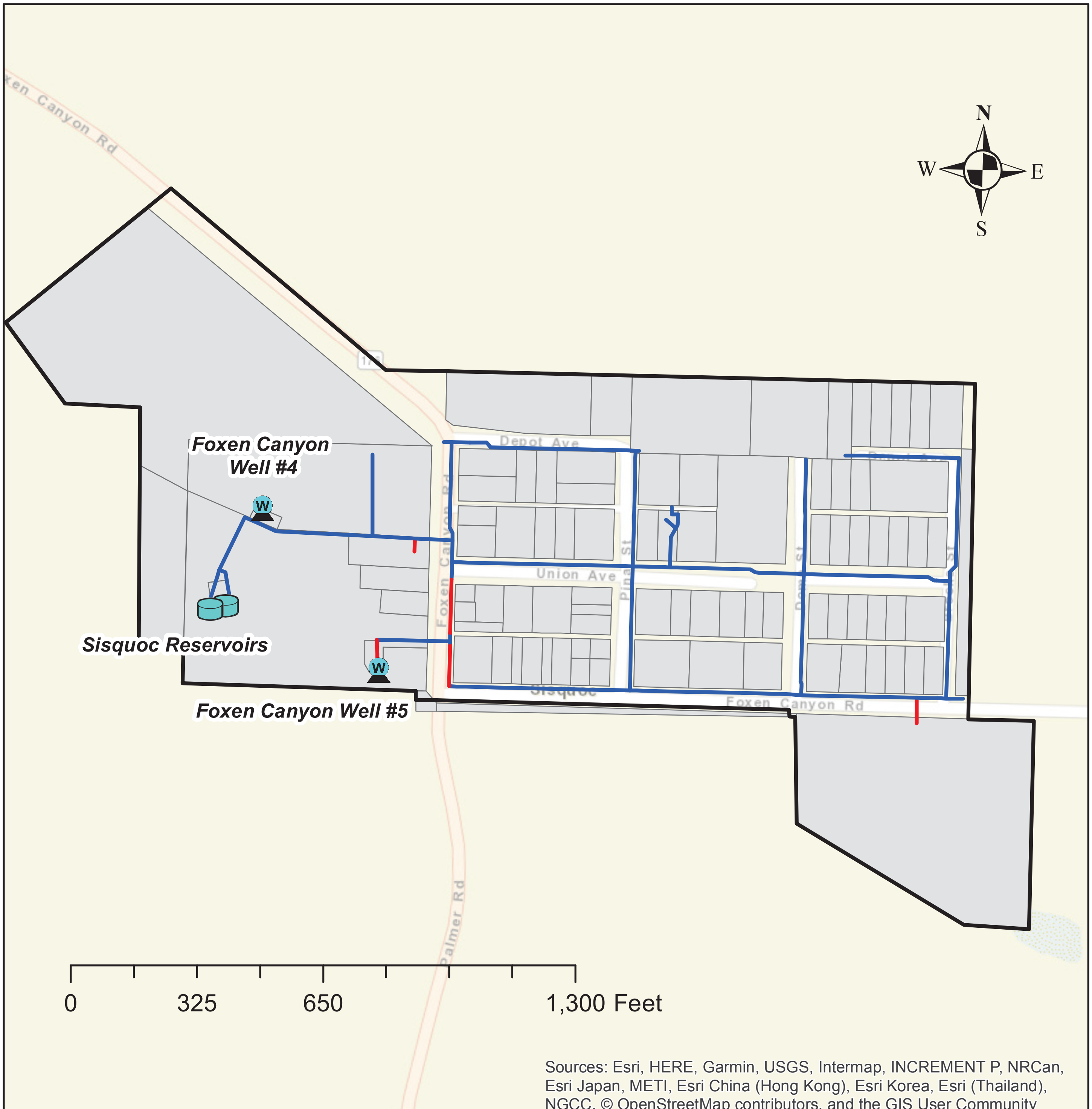
| | | | |
|---|---|---|---|
| 8 | 4,658 | 2,162 | 6,820 |
| **Totals (ft)** | 5,261 | 2,234 | **7,496** |
| **Totals (mi)** | 1.0 | 0.4 | **1.4** |
| **Percent (%)** | 70.2 | 29.8 | **100.0** |


lists the estimated footage of pipelines by diameter and year constructed.

TABLE 2-10 Pipes by Size and Year Built

| **Diameter (in)** | **Length of Pipe by Material (ft)** | | **Total Length (ft)** |
|---|---|---|---|
| | **1980-1999** | **2000-2019** | |
| 4 | 310 | 72 | 382 |
| 6 | 294 | 0 | 294 |
| 8 | 4,658 | 2,162 | 6,820 |
| **Totals (ft)** | 5,261 | 2,234 | **7,496** |
| **Totals (mi)** | 1.0 | 0.4 | **1.4** |
| **Percent (%)** | 70.2 | 29.8 | **100.0** |

# Figures




**Existing Facilities**

- BPS Booster Pump Station
- Reservoir
- W Well

**Pipelines**

- Less than 6"
- 6" or 8"
- 10" or Greater

**Pressure Zones**

- Sisquoc Zone
- Sisquoc System Boundary

**FIGURE 2-1**
**MAJOR SYSTEM FACILITIES**
GSWC REGION I MASTER PLAN
SISQUOC SYSTEM

Golden State Water Company
A Subsidiary of American States Water Company

*Last Update: 3/7/2019*

# Sisquoc System Schematic

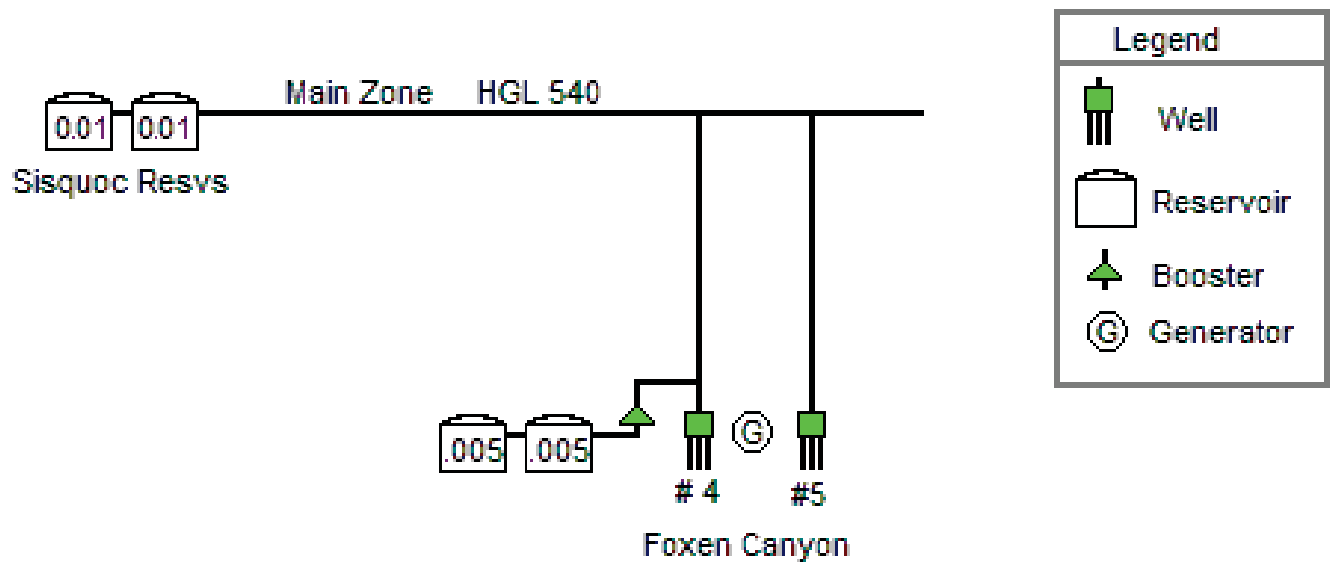



**FIGURE 2-2**
**SYSTEM SCHEMATIC**
GSWC REGION I MASTER PLAN
SISQUOC SYSTEM

Golden State Water Company
A Subsidiary of American States Water Company

SECTION 3

# Existing and Future Water Demands

This section documents existing and future water demands for the system and contains the following information:

- Demand definitions and scenarios
- Existing demands
- Peaking factors
- Future demand projections

## 3.1 Demand Definitions and Periods

Demand is classified in two basic ways:

- Demand: The total quantity of water required for a given period of time to meet the water system's various uses. These uses may include residential, commercial, industrial, and other revenue and non-revenue demands.
- Non-revenue water: The difference between the total amount of water produced from water supply sources and the total amount of water delivered to customers. This includes water used for firefighting, flushing, water lost due to system leaks and illegal connections. For systems without meters for all customers, this demand classification may not be quantifiable.

The water industry commonly uses several demand periods for developing water distribution system master plans. These demand periods are designated as average day demand (ADD), maximum day demand (MDD), peak hour demand (PHD), and maximum day demand plus fire flow (MDD+FF), and were applied as necessary to evaluate the system. The American Water Works Association (AWWA, 2005) defines these common steady-state demand periods as follows:

- ADD: Total amount of water delivered to the system in 1 year divided by 365 days.
- MDD: Maximum amount of water delivered to the system in any single day of the year.
- PHD: Amount of water required to meet peak demands during MDD. GSWC applies PHD for four hours when analyzing system supply and storage.
- MDD+FF: Amount of water required to fight a fire in addition to MDD.

## 3.2 Existing Demands

The existing demands represent a baseline for evaluating the existing system and to project future demands. The data used to develop the existing demands was based on historical water production data provided by GSWC.

### 3.2.1 Historical Water Use

For this master plan, it was assumed that the historical water production equaled the historical water demand (including non-revenue water). TABLE 3-1 summarizes historical annual water production from 2009 through 2018. The average water demand per connection for this period was 0.611 acre-feet per year per connection (AFY/conn.).

TABLE 3-1 Historical Annual Water Production

| Year | Active Service Connections | Total Demand (AFY)* | Average Demand per Connection (AFY/conn.) |
|---|---|---|---|
| 2009 | 81 | 61 | 0.753 |
| 2010 | 80 | 54 | 0.672 |
| 2011 | 78 | 50 | 0.640 |
| 2012 | 80 | 54 | 0.679 |
| 2013 | 79 | 50 | 0.631 |
| 2014 | 79 | 52 | 0.656 |
| 2015 | 77 | 34 | 0.445 |
| 2016 | 80 | 33 | 0.408 |
| 2017 | 79 | 39 | 0.496 |
| 2018 | 79 | 57 | 0.727 |
| **10-year average** | | | **0.611** |

* Includes non-revenue water use

FIGURE 3-1 summarizes the historical annual water production and number of active service connections. The figure demonstrates a correlation between the number of active service connections and the amount of water consumed. The average demand per connection varied between 0.408 and 0.753.

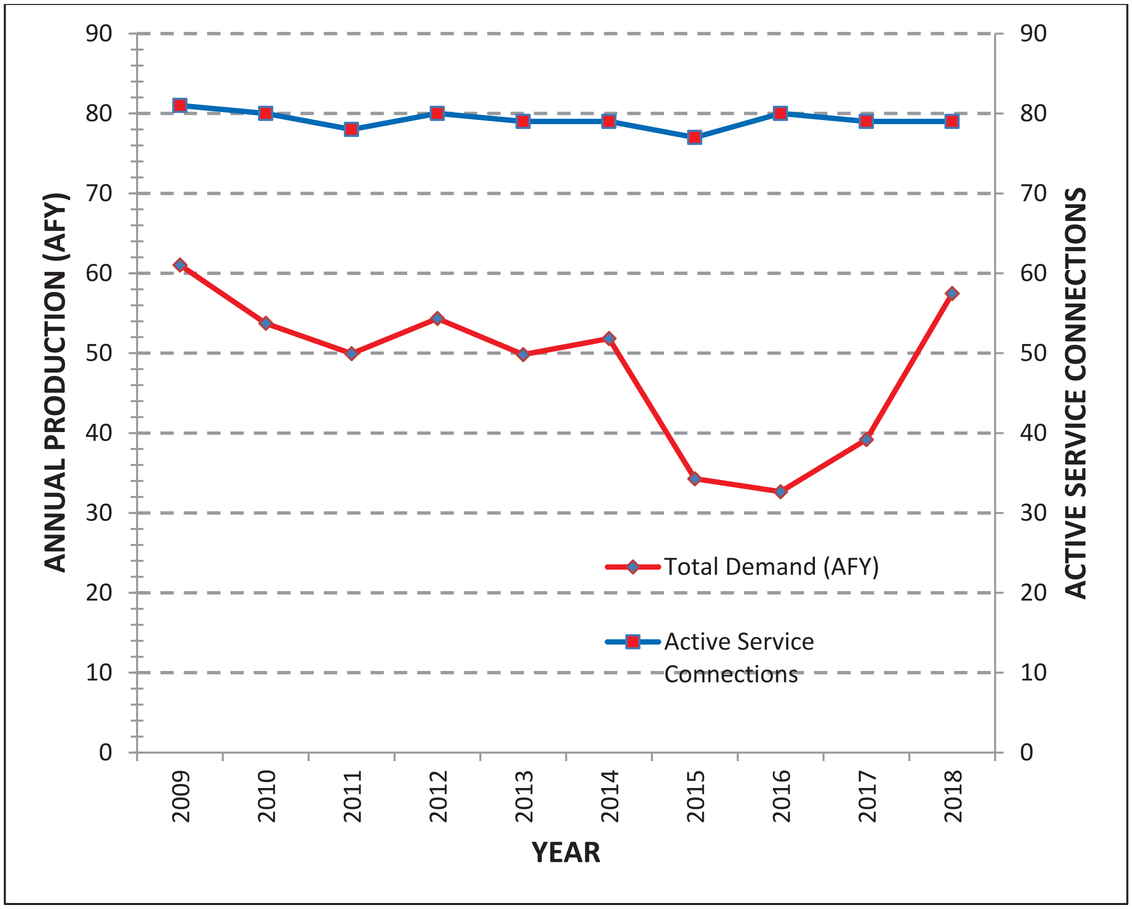



FIGURE 3-1 Historical Annual Production Totals and Active Service Connections for the Last 10 Years

### 3.2.2 Establishing Demands

The total water demand for existing conditions was estimated by multiplying the number of 2018 active service connections (79) with the 10-year average of the average demand per service connection (0.611 AFY/conn.), resulting in a system water demand of 48 AFY. Converting the system water demand to a daily demand produces an ADD of 30 gpm. This approach allows the calculation of ADD for various planning years, including the impact on anticipated growth, and then allows a direct calculation for other demand periods using the appropriate peaking factor.

To evaluate the system's performance during the MDD scenario, existing historical demand data were used in accordance with the Waterworks Standards set forth by the California Code of Regulations (2009). Section 64554.30 of the Waterworks Standards define MDD as "the amount of water utilized by customers during the highest day of use (midnight to midnight), excluding fire flow, as determined pursuant to Section 64554." Section 64554(b)(1) of the Waterworks Standards states "…identify the day with the highest usage during the past ten years to obtain MDD…". While GSWC is currently unable to track customer usage over an exact 24-hour period, GSWC does record daily water production – and, as stated in Master Plan Section 3.2.1, above, it can be "assumed that the historical water production equal[s] the historical water demand". However, because the daily production reads are not taken at midnight or always collected at the same time each day, the resulting data may be for time periods that can range anywhere from 16 to 32 hours (depending on the time of day the production data are collected). For example, the readings may be taken at 9am one day and 4pm the next; this introduces the chance of a fairly large error if only the recording for a single day is used, as it could include water production over a period longer than 24 hours. To address the possible variations in the hours per day within a given production read, GSWC identifies and uses the average of the three consecutive days with the highest production for each calendar year. By utilizing the average of these highest three consecutive days of water production, the resulting number is normalized, reducing the effect of any imprecision due to the time of day when the data was collected.

Table 3-2 presents the ADD, MDD, and peaking factor data over the last ten years.

TABLE 3-2 Historical Average and Maximum Day Demand

| | ADD[a] | | | |
|---|---|---|---|---|
| Year | AFY | gpm | MDD[b] (gpm) | MDD Peaking Factor (MDD:ADD) |
| 2009 | 61 | 38 | 74 | 1.95 |
| 2010 | 54 | 33 | 72 | 2.16 |
| 2011 | 50 | 31 | 60 | 1.95 |
| 2012 | 54 | 34 | 63 | 1.88 |
| 2013 | 50 | 31 | 77 | 2.48 |
| 2014 | 52 | 32 | 60 | 1.88 |
| 2015 | 34 | 21 | 47 | 2.20 |
| 2016 | 33 | 20 | 57 | 2.81 |
| 2017 | 39 | 24 | 52 | 2.16 |
| 2018 | 57 | 36 | 67 | 1.88 |

[a] Includes non-revenue water use
[b] Average of three consecutive highest days

Peaking factors are typically calculated as a ratio of the demand period to ADD. For example, to determine the MDD peaking factor you would divide the MDD by the ADD. Peaking factors are used to estimate future water demands as presented and discussed in Section 3.3. To determine the existing MDD, the Waterworks Standards state the following in Section 64554(b):

> *A system shall estimate MDD and PHD for the water system as a whole (total source capacity and number of service connections) and for each pressure zone within the system (total water supply available from the water sources and interzonal transfers directly supplying the zone and number of service connections within the zone), as follows:*
>
> *(1) If daily water usage data are available, identify the day with the highest usage during the past ten years to obtain MDD; determine the average hourly flow during MDD and multiply by a peaking factor of at least 1.5 to obtain PHD.*

According to TABLE 3-2, the highest MDD during the past ten years was 77 gpm, which occurred in 2013. Multiplying the MDD by a peaking factor of 1.5 results in a PHD of 115 gpm. It has been GSWC's experience that utilizing a peaking factor of 1.5 has been sufficient to meet PHD. Projected system demands for the ADD, MDD, and PHD scenarios are summarized in TABLE 3-3.

TABLE 3-3 Projected System Demands by Demand Period

| Demand Period | GPM |
|---|---|
| ADD | 30 |
| MDD | 77 |
| PHD | 115 |

## 3.3 Future Demand Projections

Future demands were projected first to estimate future ADD, and then peaking factors were applied to estimate MDD and PHD. The following sources of data and approaches were used:

- Growth-rate projections
- Water-demand projections

### 3.3.1 Growth Rate Projections

Growth rate projections were evaluated against equivalent estimates in the previous Sisquoc System Water Master Plan and year 2010 U.S. census data to correlate population growth with the increase in service connections. This correlation was then used to determine future water demand.

### 3.3.2 Water Demand Projections

The projected annual water demands for the Sisquoc System are based on the projected number of service connections, extrapolated to year 2040 to determine the projected water use.

FIGURE 3-2 presents the historical and projected annual water demands, including the most recent 10-year period. Projections of future demands are equivalent to the existing demand (2019) of 48 AFY.

The State of California is in a long term drought and the Governor has issued Executive Orders that will likely result in significant reductions in future demands. This Master Plan utilizes the current requirements established by the State of California and California Public Utilities Commission in evaluating needed facilities but acknowledges that the requirements may change. Subsequent updates to this Master Plan will reflect future changes in requirements.

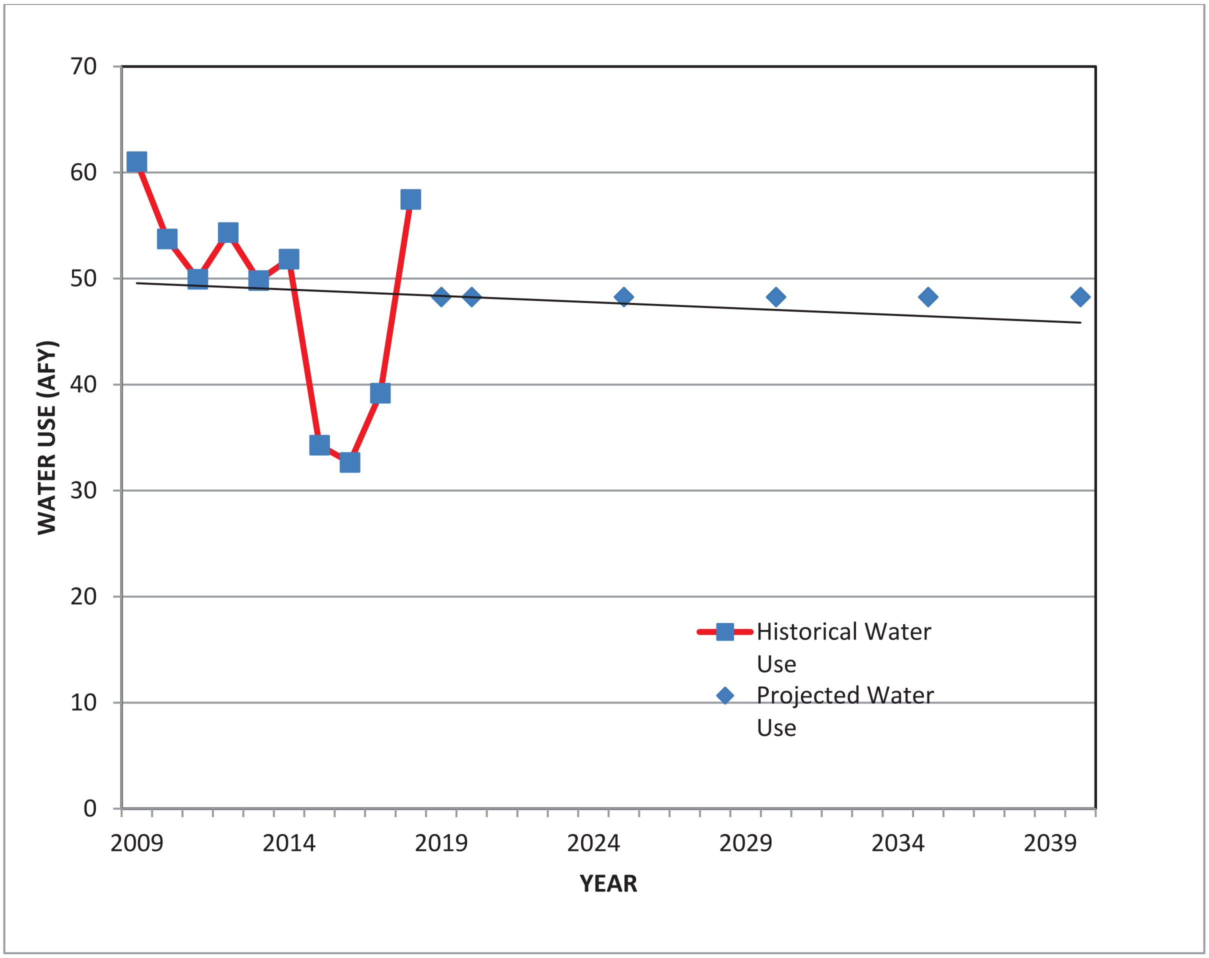



FIGURE 3-2 Historical Water Demand and Future Water Demand Projections

The water demands for 2040 project to be 48 AFY, resulting in an ADD of 30 gpm. To determine the projected MDD for year 2040, a peaking factor from TABLE 3-2 was applied to the projected ADD. The peaking factor associated with the highest MDD during the past ten years, 2.48 in 2013, was selected, resulting in a MDD of 74 gpm. A peaking factor of 1.5 was multiplied by the projected MDD to determine the projected PHD, which is 111 gpm. TABLE 3-4 summarizes the projected demands for ADD, MDD, and PHD periods.

TABLE 3-4 Water System Demands by Demand Period

| | Demand Period and Peaking Factor | | | |
|---|---|---|---|---|
| **Planning Year** | **Annual Average (AFY)** | **ADD (gpm)** | **MDD (gpm)** | **PHD (gpm)** |
| 2019 | 48 | 30 | 77 | 115 |
| 2040 | 48 | 30 | 74 | 111 |

SECTION 4

# Hydraulic Model Development and Calibration

## 4.1 Overview

A computerized hydraulic model of a water distribution system is an important tool used as part of the Water Master Plan to conduct hydraulic analyses of the water system.

The computer model is used to analyze the facilities, operational characteristics, and water supply and consumption data of a water system. The water distribution system hydraulic model includes pipes, junction nodes (connection points for pipes and location of demands), valves, wells, pumps, purchased water connections, tanks, and reservoirs. Operational characteristics include parameters that control the method by which the water is distributed through the system, such as on and off settings for pumps, pressure or flow controls for hydraulically actuated valves, or main line valve closures. Data for supply and consumption determine where the water supply and demands are applied within the modeled distribution system.

Accurate computer model development begins with entering the correct information into the data file and calibrating the model to match existing conditions in the field. Once this foundation is complete, the resulting model becomes an invaluable tool. It can simulate the existing and future water system, identify system deficiencies, analyze impacts from increased demands, and determine the effectiveness of proposed improvements.

## 4.2 Construction and Calibration of the Hydraulic Computer Model

A new Sisquoc System hydraulic model was revised as part of the 2016 Master Plan. For this Master Plan, the model was checked for accuracy and updated to include newly constructed facilities. Valve settings for pressure regulating valves were also verified, and the system demands were validated. Localized calibration was performed to refine the model in certain sections of the system.

## 4.3 Summary

This Master Plan update included verification of the physical components represented in the hydraulic model, validation of demands in the model, and localized field testing and calibration.

It is important to note that model calibration for any water system is an ongoing effort. As changes in the system occur from changing demands, new infrastructure development, or changing operational settings, the model must be periodically updated and checked to ensure agreement with field measurements. This update serves as a baseline for future calibration efforts by GSWC.

SECTION 5

# Supply and Storage Capacity Evaluation

This section documents the evaluation of the water supply and storage capacity for the Sisquoc System. The evaluation results accomplished the following:

- Established storage needs for each pressure zone and the entire distribution system
- Identified supply and/or storage deficiencies in the existing and future systems
- Proposed improvements that mitigate the deficiencies identified

In each subsection, the supply and storage capacity of the existing and future water systems were measured against the objectives identified in the technical memorandum titled *Master Planning Criteria and Standards* (see Appendices). When the analysis indicated that the system did not meet these criteria, a deficiency was identified and facilities were proposed to mitigate the deficiency.

## 5.1 Overview

To provide a reliable water supply, a water system must be able to meet the system demands under a variety of conditions. The water supplied may be provided by a combination of supply sources, or stored water, or both. The specific demand period being analyzed may limit the source of water for the scenario. For example, stored water should not be used to meet ADD or MDD but could be used for PHD or MDD+FF. Therefore, each demand period may require a different ratio of water supplies and storage. This analysis examines various demand periods to determine if the system has the ability to reliably meet the system demands under typical demand scenarios using a combination of water supply sources and storage.

## 5.2 Evaluation Approach

This supply and storage capacity analysis examined the Sisquoc System under two planning periods:

- **Existing (2019) system.** The demands for the existing water system were determined by multiplying the 10 year historical average demand per connection and the most recent number of connections (year 2018) to obtain the total system demand. The analyses assumed all facilities that were operational in 2019.

- **2040 system.** The long-term planning horizon (2040) water system analysis assumed 2040 demands (assumed buildout) and facilities included in the existing system analysis plus facilities needed to correct deficiencies in 2040.

### 5.2.1 Analysis Criteria

The Sisquoc System must be capable of providing sufficient water supply and storage capacity to meet the minimum criteria summarized in TABLE 5-1. These criteria were extracted from the technical memorandum titled *Master Planning Criteria and Standards*.

The criteria apply to the system as a whole and to each pressure zone in the system. For planning purposes, this Master Plan utilizes the Planning Scenario 'MDD + Fire Flow' to analyze the system performance under a worst-case planning scenario. The worst-case planning scenario is represented by applying the single most stringent fire flow requirement established (based on land use plans or as designated by the local fire jurisdiction) for a structure within a hydraulic zone or planning area as the baseline fire flow requirement for the entire hydraulic zone or planning area. For the purposes of the planning analysis, this is considered a goal rather than a requirement. If the result of the worst case planning scenario indicates a deficiency in MDD + Fire Flow, it should be noted that there may not be a deficiency in the actual fire flow requirement for a particular structure, but rather that GSWC is not meeting the planning goal for the overall hydraulic zone or planning area.

TABLE 5-1 Supply and Storage Capacity Analysis Criteria

| Planning Scenario | Demand and Duration | Evaluation Criterion | Storage Usage | Facilities Assumed to be Out of Service |
|---|---|---|---|---|
| Average day | ADD for 24 hours | Total capacity | No storage drawdown | - |
| Maximum day | MDD for 24 hours | Firm capacity | No storage drawdown | Largest pumping unit in system |
| Peak hour | PHD for 4 hours[1] | Firm capacity | Operational storage | Largest pumping unit in system |
| MDD + fire flow | MDD plus fire flow, duration varies[2] | Total capacity | Fire storage | - |

[1] Operational storage required to meet peak demands during MDD was defined as the supply needs during 4 hours of PHD.
[2] Fire flow scenarios are based on fire agency maximum flow requirements for a single structure within a planning area and are applied throughout the planning area as part of the planning analysis. Actual fire flows may be less than the maximum fire flow used for planning analysis.

It is worth noting that the California Public Utilities Commission (CPUC) and State Water Resources Control Board, Division of Drinking Water (DDW) currently provide no specific requirements for storage volume. Therefore, recommended standards published by the American Water Works Association (AWWA) were considered in the development of the storage criteria used in this master plan.

### 5.2.2 Storage

In addition to providing adequate water supplies for the water consumers, water distribution systems often rely on stored water within the distribution system to provide the following operational benefits:

- Help equalize fluctuations between supply and demand.
- Supply sufficient water for firefighting.
- Meet demands during an emergency or unplanned outage of a major supply source.

AWWA defines three types of storage: operational, fire, and emergency. The amount of storage required for each of these types varies by system. Nevertheless, all three types of storage must be considered. In some cases, water stored in the groundwater basin can provide some of this storage. However, when the stored water does not flow by gravity and requires pumping, sufficient pumping redundancy and stand-by power generators must be provided if the storage source is to be considered reliable.

This analysis evaluates the ability of the system's storage facilities to meet the water system's storage requirements. The resulting volume must be allocated to the pressure zones where the demands exist, or to a neighboring zone (if there are pressure-regulating stations or check valves available that allow the water to flow into the neighboring zone). The water system must also be evaluated to determine if existing booster stations provide sufficient water to be pumped into the higher-pressure zones.

TABLE 5-2 presents the recommended operational, fire, and emergency storage criteria as defined by GSWC for the Sisquoc System.

TABLE 5-2 Criteria for Calculating Storage

| Storage Category | GSWC Criteria |
|---|---|
| Operational | Storage volume to meet PHD in addition to MDD supply |
| Fire | Maximum recommended fire storage volume in the system |
| Emergency | ADD for 12 hours |

### Operational Storage

The required volume of water for operational storage is determined by the volume needed for regulating the difference between the rate of supply and the daily variations (peaks) in water usage. This difference results in the lowest and highest operating levels in the reservoirs under normal conditions. The resulting volume must be allocated to either the pressure zone (where the demands exist) or to a higher-pressure zone (for use by the lower-pressure zone).

### Fire Storage

The volume of water required for firefighting is a function of the instantaneous flow rate required to fight the fire over the duration of the fire flow event as determined by the local fire jurisdiction. Consideration is also made to evaluate the number of fire flow events that may occur before the volume can be replenished. Further, the volume of water necessary to fight a fire can be provided from water supply, water storage, or a combination thereof. For planning purposes, it is desirable and conservative to design the water system to have capacity within water tanks for the volume of water needed for firefighting; however, the fire storage in the tanks plus available supply in excess of MDD can be utilized to meet firefighting requirements. The fire-flow requirements listed in TABLE 5-3 were used to establish the flow rate and duration for each pressure zone; these criteria were used to identify the largest volume of water required for firefighting within each pressure zone (based on the land use in that zone and the flow rates and durations from TABLE 5-3). The resulting fire-flow volumes are shown in TABLE 5-3.

TABLE 5-3 Fire Storage Volumes

| Land Use Category | Minimum Fire Flow Required (gpm) | Duration (hr) | Recommended Fire Storage Volume (MG) |
|---|---|---|---|
| School | 1,500 | 2 | 0.18 |
| Residential | 750 | 2 | 0.09 |

MG: million gallons

For the Sisquoc System, it was assumed that only one fire event within the system would occur before storage tanks could recover. The lowest fire-flow volume (0.09 MG) is the result of a 750-gpm fire for duration of 2 hours (residential land use). The largest fire-flow volume (0.18 MG) is the result of a 1,500-gpm fire for a duration of 2 hours (school use).

#### Emergency Storage

Emergency storage is a dedicated source of water that can be used as a backup supply in the event a major supply source is interrupted. This can be provided by water from a second independent source, by water stored in reservoirs, or a combination of both. *Ten States Standards* recommends that emergency storage total between 12 and 24 hours of ADD volume. Because the Sisquoc System contains multiple supply sources and a storage reservoir, 12 hours of ADD volume for this system is appropriate.

## 5.3 Existing System Evaluation

Evaluation of the existing system's supply and storage capacity involved analysis of key system facilities to identify supply or storage capacity deficiencies. This approach involved analyzing multiple proposed improvement alternatives to address these deficiencies. These proposed improvements were then evaluated to determine the most cost-effective alternatives, which would then be identified as the recommended improvements and incorporated into the CIP. The following subsections describe the existing system evaluation:

- Water demands for each demand period
- Supply facilities
- Storage facilities
- Capacity analysis
- Proposed improvements to address deficiencies in the existing system

### 5.3.1 Existing System Water Demands for Each Demand Period

TABLE 5-4 defines the existing demands for each demand period, based on the spatial demand allocation from the Sisquoc GIS.

TABLE 5-4 Existing System Water Demands

| Pressure Zone | ADD (gpm) | MDD (gpm) | PHD (gpm) | Demand by Zone (%) |
|---|---|---|---|---|
| Main Zone | 30 | 77 | 115 | 100 |
| **Total** | **30** | **77** | **115** | **100** |

### 5.3.2 Existing System Supply Facilities

The existing water supply facilities in the Sisquoc System were identified in Section 2, Existing Water System Facilities. TABLE 5-5 summarizes the design production capacity of each supply source and systemwide totals for total capacity and firm capacity.

TABLE 5-5 Existing System Supply Facilities

| Facility Name | Source | Pressure Zone | Total Capacity (gpm) |
|---|---|---|---|
| Foxen Canyon Well #4 | Groundwater | Main Zone | 100 |
| Foxen Canyon Well #5 | Groundwater | Main Zone | 100 |
| **Main Zone total** | | | **200** |
| **Systemwide total** | | | **200** |

### 5.3.3 Existing System Storage Facilities

The existing storage facilities in the Sisquoc System are described in Section 2, Existing Water System Facilities. TABLE 5-6 summarizes the storage facilities for the Sisquoc System.

TABLE 5-6 Existing System Storage Facilities

| Facility Name | Primary Pressure Zone Served | Total Capacity (MG) |
|---|---|---|
| Sisquoc Reservoir #1 | Main Zone | 0.01 |
| Sisquoc Reservoir #2 | Main Zone | 0.01 |
| **Total storage capacity** | | **0.02** |

### 5.3.4 Existing System Supply and Capacity Analysis

This analysis of the existing water distribution system evaluated the two pressure zones separately and then the system as a whole to verify that adequate supply and storage facilities were available. The analysis reviewed the demand periods (ADD, MDD, PHD, MDD+FF and both planned and unplanned MWD outages); the duration for each demand period is detailed in TABLE 5-1. The duration of MDD+FF was established by the fire-flow criteria identified in TABLE 5-3.

In the following subsections, an analysis is performed for each pressure zone and for the overall system. The demands and production capacities for each zone are presented in a table that summarizes the results. These tables present the demands for each demand period in the zone and for any zones that depend on this zone for supplies. These demands are presented as a flow rate and are converted into a demand volume using the duration for the demand period. For example, a demand of 100 gpm for ADD would be equal to a demand volume of 144,000 gallons, given that the duration of ADD is 24 hours.

Available supplies are presented below the demand volume totals. Available supplies include water supply sources, booster pumping capacity, and stored water. Stored water was not used to provide water supplies during ADD or MDD. Stored water that was allocated as operational storage was assumed to be available for PHD, and water stored for fire flows was assumed to be available for MDD+FF. The total supplies were assumed to be available for ADD and MDD+FF. For the purpose of assuring reliable water service is provided to customers, each zone's ability to meet MDD and PHD with firm capacity was analyzed. (Firm capacity was defined as the available capacity with the largest pumping unit out of service.) The available production was calculated by converting flow rates into a production volume (using the duration of the demand period) and adding the available storage volume.

The last two lines of the table compare the system's available production capacity to the demands for the same duration. Where production capacity exceeds demands, the row *supply minus demand* will be positive. This indicates an adequate combination of supplies and storage. Where this occurs, the last row of the table, *supply meets demand*, will contain *yes*. However, if demands exceed production, then the row *supply minus demand* will have a negative value, and the row *supply meets demand* will contain *no*. In this latter case, proposed improvements were evaluated to correct the deficiency.

### Systemwide Capacity Analysis

In the systemwide analysis, all supply and storage facilities were included. The total existing demands were presented in TABLE 5-4. The total and firm production capacities in TABLE 5-5 and the storage facilities in TABLE 5-6 were used for the appropriate demand periods. The fire flow used for MDD+FF was based on the largest fire flow in the system, a 3,500-gpm fire flow for 3-hour duration. The results of the systemwide supply and storage analysis for the existing system are summarized in TABLE 5-7.

TABLE 5-7 Existing System Supply and Capacity Analysis—Systemwide

| | | Planning Scenario | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | **ADD** | | **MDD** | | **PHD** | | **MDD+FF** | |
| Duration (Hours) | | 24 | | 24 | | 4 | | 2 | |
| Demand | | GPM | MG | GPM | MG | GPM | MG | GPM | MG |
| Main Zone | | 30 | 0.043 | 77 | 0.110 | 115 | 0.028 | 1,577 | 0.189 |
| **Total Demand** | | **30** | **0.043** | **77** | **0.110** | **115** | **0.028** | **1,577** | **0.189** |
| Supply | Capacity | | | | | | | | |
| Wells | 200 | 200 | 0.288 | 100 | 0.144 | 100 | 0.024 | 200 | 0.024 |
| Reservoirs | 0.02 | - | - | - | - | 38 | 0.009 | 167 | 0.020 |
| **Total Supply** | | **200** | **0.288** | **100** | **0.144** | **138** | **0.033** | **367** | **0.044** |
| **Supply Minus Demand** | | **170** | **0.245** | **23** | **0.034** | **23** | **0.005** | **-1,210** | **-0.145** |
| **Supply Meets Demand** | | **YES** | | **YES** | | **YES** | | **NO** | |

The systemwide supply and storage analysis results for the existing system indicate that the existing supply meets the demands for all planning scenarios except for MDD+FF. Proposed improvements to overcome this deficiency are described in Section 5.3.6.

## 5.3.5 Existing System Storage Analysis

The analysis of the existing storage facilities evaluated the required storage for each pressure zone and compared it to the existing storage available for each zone to determine the storage deficiencies. The benefits of storage and the types of storage (operational, fire, and emergency) are described in more detail in section 5.2.2.

TABLE 5-8 evaluates the three types of storage to calculate the total required storage for each zone and the entire system. The operational storage is calculated by subtracting the MDD from the PHD to obtain the additional flowrate that is required during the PHD scenario. This additional flowrate is multiplied by the duration of PHD and then converted to a volume to determine the required operational storage. A duration of four hours was used to account for the typical duration of peak demands during the day. The fire storage for each zone is based on criteria given in section 5.2.2. In cases where two or more pressure zones retain their fire storage in the same reservoir, that reservoir only needs to contain the fire storage for the zone with the largest recommended fire storage volume. This is because the criteria consider only one fire flow can occur in the system at any given time. To prevent accounting for excess fire storage, pressure zones were given a fire storage total of 0 MG in TABLE 5-8 when fire storage of larger or equal size was used in another zone that retains its fire storage in the same tank. The emergency storage is the volumetric measurement of the ADD over a duration of 12 hours.

Storage deficiencies are identified for each zone in TABLE 5-9. All tanks in the existing system are listed in the left column of the table. All pressure zones in the existing system are listed in the top row of the table. The numbers in the table represent the allotted amount of storage, in millions of gallons, for each zone from each tank. A dash in the table denotes storage from that tank is unavailable for that zone. Zones that are able to utilize storage in a tank, but are not allotted any storage from it are shown in the table as zero. Summing the numbers across the rows results in the total storage volume of the tank listed in the left column of that row. Summing the numbers going down the columns results in the available storage for the zone listed in the top row of that column. The required storage, taken from TABLE 5-8, is given in the row below the available storage. Subtracting the required storage from the available storage within a column results in the excess storage for that column's zone. Negative numbers imply a storage deficiency and are given a "NO" in the adequate storage column. A "YES" in the adequate storage column implies there is adequate storage available for that zone. Fire storage is calculated to supplement supply when the supply is less than the current demand plus fire flow (see Section 5.3.4). Fire storage requirements are planning standards and fire storage is typically only required in times of high demands, supply limitations, and/or emergencies.

TABLE 5-8 Existing System Storage Analysis - Calculated Storage

| | Zones |
|---|---|
| | **Systemwide** |
| **Operational** | |
| PHD | 115 |
| MDD | 77 |
| PHD minus MDD | 38 |
| Duration | 4 |
| MG | 0.009 |
| **Fire** | |
| GPM | 1,500 |
| Duration | 2 |
| MG* | 0.180 |
| **Emergency** | |
| ADD | 30 |
| Duration | 12 |
| MG | 0.022 |
| **Total Recommended Storage** | **0.211** |

NOTE: All demand period scenarios (ADD, MDD, and PHD) are given in gallons per minute (GPM). All durations are given in hours. The rows titled "MG" and the total required storage are given in million gallons (MG)

TABLE 5-9 Existing System Storage Analysis - Adequacy Evaluation

| | Zones | |
|---|---|---|
| | **Systemwide** | **Total** |
| **Sisquoc Reservoir 1** | 0.010 | 0.010 |
| **Sisquoc Reservoir 2** | 0.010 | 0.010 |
| **Available Storage** | 0.020 | 0.020 |
| **Recommended Storage*** | 0.211 | 0.211 |
| **Available Minus Recommended** | -0.191 | -0.191 |
| **Adequate Storage** | **NO** | **NO** |

The existing system storage analysis results indicate a 0.190 MG storage deficiency. Proposed improvements to overcome this storage deficiency are described in Section 5.3.6.

### 5.3.6 Proposed Improvements to Address Deficiencies in the Existing System

Various alternatives were considered while investigating improvements to correct the deficiencies identified in the supply and storage evaluation; these are listed in TABLE 5-10. Deficiencies may be corrected by adding supply, storage, or a combination of both. In these cases, the deficiency is shown in both supply (gpm) and storage (MG). The descriptions of the deficiency alternatives are given at the end of TABLE 5-10.

The deficiencies identified in the supply and storage evaluation were a storage deficiency of 0.191 MG, calculated using the criteria defined in TABLE 5-2, and supply and storage analysis deficiencies of:

- 1,210 gpm (0.145 MG) for MDD+FF

The numbering system used in TABLE 5-10 is a series of three numbers. The first number indicates the planning period: 1 for the existing system and 2 for the 2040 system. The second number indicates the deficiency number, which starts at 1 and increments by 1 for each deficiency identified. The third number identifies the improvement alternative, but zero is reserved for the deficiency. Therefore, the alternative number 1.2.3 would be used to identify the third proposed alternative for the second deficiency in the existing system.

TABLE 5-10 Existing System Proposed Supply and Storage Improvements

| Deficiency/ Alternative Number | Deficiency/Alternative Description | Pressure Zone | Supply Capacity (gpm) | Storage Capacity (MG) |
|---|---|---|---|---|
| **1.1.0** | **Inadequate storage** | **Main Zone** | | 0.191 |
| 1.1.1 | Construct reservoir | Main Zone | | 0.191 |
| **1.2.0** | **Inadequate supply for MDD+FF** | **Main Zone** | 1,210 | 0.145 |
| 1.2.1 | Construct reservoir | Main Zone | | 0.145 |
| 1.2.2 | Construct well(s) | Main Zone | 1,210 | |

### Descriptions of Deficiency Alternatives

***Deficiency No. 1.1.0***

*Alternative No. 1.1.1*

This alternative proposes to construct a 0.191 MG reservoir in the Main Zone, at a site to be determined. (Note: A new reservoir, with a storage capacity of 0.20 MG, was approved in the 2017 GRC and is currently under design.)

***Deficiency No. 1.2.0***

*Alternative No. 1.2.1*

This alternative proposes to construct a 0.145 MG reservoir in the Main Zone, at a site to be determined.

*Alternative No. 1.2.2*

This alternative proposes to increase the supply capacity to the Main Zone by an additional 1,210 gpm. Adding a new well could resolve this deficiency.

## 5.3.7 Recommended Improvements to Address Deficiencies in the Existing System

Recommended improvements to resolve the deficiencies in the existing system are given in TABLE 5-11. These proposed improvements were recommended for their ability to correct the deficiency and be cost-effective compared to competing alternatives. Refer to the 'Descriptions of Deficiency Alternatives' in section 5.3.6 for more detailed descriptions of proposed improvements. In some cases, the capacity of the proposed improvement is larger than described in the 'Descriptions of Deficiency Alternatives'. This was necessary in order to resolve multiple deficiencies.

TABLE 5-11 Existing System Recommended Supply and Storage Improvements

| Alternative Number | Alternative Description | Deficiencies Resolved | Supply/Storage Capacity |
|---|---|---|---|
| 1.1.1 | Construct reservoir* | 1.1.0, 1.2.0 | 0.20 MG |

* A 0.20 MG reservoir, approved in the 2017 GRC, is currently under design.

## 5.4 2040 System Evaluation

Analysis of the water system for the year 2040 was performed to identify long-term improvements needed for the water system at buildout. This analysis included the following assumptions:

- Existing supply sources would remain active or be replaced in kind.
- Planned improvements to address existing system deficiencies plus the post-2012 improvements are operational.
- The demands developed in Section 3, Existing and Future Water Demands, were assumed for the respective demand periods.

### 5.4.1 2040 System Water Demands for Each Demand Period

TABLE 5-12 defines the 2040 demands for the Sisquoc System.

TABLE 5-12 2040 System Water Demands

| | ADD (gpm) | MDD (gpm) | PHD (gpm) |
|---|---|---|---|
| Systemwide | 30 | 74 | 111 |

### 5.4.2 2040 System Supply Facilities

The supply facilities for the 2040 system include all supply facilities in the existing system along with all recommended supply facilities to resolve the existing system's deficiencies. TABLE 5-13 summarizes the supply for the 2040 System.

TABLE 5-13 2040 System Assumed Supply Facilities

| Facility Name | Total Capacity (gpm) |
|---|---|
| Additional facilities in the 2040 System | 0 |
| Existing supply – Wells | 200 |
| **Total production capacity for 2040** | **200** |

### 5.4.3 2040 System Storage Facilities

The storage facilities for the 2040 system include all recommended storage facilities to resolve the existing system's deficiencies. The 0.02 MG of existing storage would be abandoned after construction of a new 0.2 MG reservoir, and is therefore not included in the 2040 System total. TABLE 5-14 summarizes the storage for the 2040 System.

TABLE 5-14 2040 System Assumed Storage Facilities

| Facility Name | Primary Pressure Zone Served | Total Capacity (MG) |
|---|---|---|
| Recommended storage facilities | Main | 0.20 |
| Existing storage | Systemwide | N/A |
| **Total storage capacity** | | **0.20** |

### 5.4.4 2040 System Capacity Analysis

The supply analysis for the 2040 system uses the 2040 projected demands and includes the recommended 2040 supply improvements to analyze system deficiencies. An analysis is not given for each pressure zone because it is unknown how much each zone's demands will increase by year 2040. The supply analysis is given in TABLE 5-15.

TABLE 5-15 2040 System Supply and Capacity Analysis—Systemwide

| | | Planning Scenario | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | **ADD** | | **MDD** | | **PHD** | | **MDD+FF** | |
| Duration (Hours) | | 24 | | 24 | | 4 | | 2 | |
| Demand | | GPM | MG | GPM | MG | GPM | MG | GPM | MG |
| **Total Demand** | | **30** | **0.043** | **74** | **0.107** | **111** | **0.027** | **1,574** | **0.189** |
| Supply | Capacity | | | | | | | | |
| Wells | 200 | 200 | 0.288 | 100 | 0.144 | 100 | 0.024 | 200 | 0.024 |
| Reservoirs | 0.20 | - | - | - | - | 37 | 0.009 | 1,500 | 0.180 |
| **Total Supply** | | **200** | **0.288** | **100** | **0.144** | **137** | **0.033** | **1,700** | **0.204** |
| **Supply Minus Demand** | | **170** | **0.245** | **26** | **0.037** | **26** | **0.006** | **126** | **0.015** |
| **Supply Meets Demand** | | **YES** | | **YES** | | **YES** | | **YES** | |

The systemwide supply and storage analysis results for the 2040 system indicate that the supply meets the demands for all planning scenarios.

### 5.4.5 2040 System Storage Analysis

The storage analysis for the 2040 system uses the 2040 projected demands and includes the recommended supply and storage improvements for the existing system to analyze system deficiencies. Like the 2040 supply analysis, each pressure zone is not analyzed because it is unknown how much each zone's demands will increase by year 2040. The storage analysis is given in TABLE 5-16.

TABLE 5-16 2040 System Storage Analysis

| Scenario | | Systemwide |
|---|---|---|
| **Operational** | PHD | 111 |
| | MDD | 74 |
| | PHD minus MDD | 37 |
| | Duration | 4 |
| | MG | 0.009 |
| **Fire** | GPM | 1,500 |
| | Duration | 2 |
| | MG* | 0.180 |
| **Emergency** | ADD | 30 |
| | Duration | 12 |
| | MG | 0.022 |
| Total Recommended Storage | | 0.210 |
| Available Storage in 2040 | | 0.200 |
| Available minus Recommended | | -0.010 |
| **Adequate Storage** | | NO |

The 2040 system storage analysis results indicate a 0.010 MG storage deficiency. However, as shown in TABLE 5-15, there is 0.011 MG excess capacity available after utilizing reservoir storage to help meet PHD and MDD+FF demands; therefore, no additional storage capacity will be proposed.

### 5.4.6 Proposed Improvements to Address Deficiencies in the 2040 System

No deficiencies were identified in the supply and storage evaluation for the Sisquoc System.

TABLE 5-17 2040 System Proposed Supply and Storage Improvements

| Deficiency/ Alternative Number | Deficiency/Alternative Description | Pressure Zone | Supply Capacity (gpm) | Storage Capacity (MG) |
|---|---|---|---|---|
| - | - | - | - | - |

### 5.4.7 Recommended Improvements to Address Deficiencies in the 2040 System

No deficiencies were identified in the Sisquoc System.

TABLE 5-18 2035 System Recommended Supply and Storage Improvements

| Alternative Number | Alternative Description | Deficiencies Resolved | Supply/Storage Capacity |
|---|---|---|---|
| - | - | - | - |

## 5.5 Summary of Proposed Supply and Storage Improvements through 2040

According to the supply and capacity analysis results in this Master Plan, the following additional supply is necessary to meet future demands:

- Existing system: 1,210 gpm of additional supply for MDD+FF
- 2040 system: no additional supply

Since the supply deficiency is in the MDD+FF category, it will be addressed by satisfying the storage deficiency below.

According to the storage analysis results in this Master Plan, the following additional storage is necessary to meet future demands:

- Existing system: 0.191 MG of additional storage
- 2040 system: no additional storage

A 0.20 MG reservoir is recommended, in order to resolve the deficiencies of the existing system, including MDD+FF. This additional reservoir was approved in the 2017 GRC and is currently under design, and when constructed will adequately address all storage deficiencies for the Sisquoc System through 2040.

The supply and storage improvements planned by GSWC and analyzed in these evaluations are further examined in Section 6, Hydraulic Analysis and Evaluation. The hydraulic analysis helps determine the optimal configuration of improvements to provide maximum operational and cost benefit, and any resulting recommended improvements are incorporated into the CIP.

SECTION 6

# Hydraulic Analysis and Evaluation

This section documents the hydraulic analysis and evaluation results for the Sisquoc System. The hydraulic analysis used the calibrated computer model to evaluate the existing water system. This analysis and evaluation accomplished the following tasks:

- Summarized the criteria for the hydraulic analysis
- Performed simulations for various demand conditions and demand periods
- Analyzed the modeling results to identify deficiencies
- Analyzed various proposed improvements to investigate ways to mitigate these deficiencies
- Developed a list of recommended improvements that provide a cost-effective means to correct deficiencies

In following sections, the hydraulic analysis results of the existing water system were compared with the objectives identified in the technical memorandum titled *Master Planning Criteria and Standards* (see Appendices). When the analysis indicated that the system did not meet these criteria, a deficiency was identified and improvements were proposed to mitigate the deficiency.

## 6.1 Overview

Hydraulic analyses of networked water distribution systems are most efficiently performed with the aid of hydraulic computer models and specialized software that perform the numerical analysis. The hydraulic computer model assists with measuring system performance, analyzing operational improvements, and developing a systematic method of determining the size and timing required for new facilities. The model can be used to analyze existing water systems, future water systems, and the effect of specific improvements. By analyzing numerous planning scenarios relatively quickly and easily, the model provides answers to several "what if" questions. The computer program analyzes all of the information in the system data file and generates results in terms of pressures, flow rates, and operating status. The key to successfully using the computer model is correct interpretation of these results, and understanding how the water distribution system was affected.

## 6.2 Analysis Approach

This hydraulic analysis examined the Sisquoc System for only one planning period:

- **Existing (2019) system.** The existing water system analyses assumed 2019 demands, as described in Section 3, and facilities that were operational in 2019.

The demands used in this hydraulic analysis are the same as used for the supply and storage capacity analysis in Section 5.

### 6.2.1 System Performance Criteria

Hydraulic analysis of the water system involved the use of a computer model that was developed specifically for the Sisquoc System and calibrated to conditions observed in the field (see Section 4, Hydraulic Model Development and Calibration). This computer model was used to identify hydraulic deficiencies under the existing planning scenario. Hydraulic model simulations were developed to analyze demand periods (ADD, MDD, PHD, and MDD+FF) to determine whether the system could meet the performance objectives identified for this master plan. These criteria are summarized in TABLE 6-1.

TABLE 6-1 Hydraulic Analysis Criteria

| Demand Period | Pipeline Criteria[a] | Pressure Criteria[b] |
|---|---|---|
| ADD | Velocity less than 5 fps and head loss less than 6 ft per 1,000 ft | Greater than 40 psi and less than 125 psi |
| MDD | Velocity less than 5 fps and head loss less than 6 ft per 1,000 ft | Greater than 40 psi and less than 125 psi |
| PHD | Velocity less than 10 fps | Greater than 30 psi and less than 125 psi |
| MDD + fire flow | Velocity less than 10 fps | Greater than 20 psi |

[a] If velocity or headloss in a pipeline exceeded the criteria listed but did not result in low pressures in the system, the pipeline was not recommended for replacement due to hydraulic deficiencies alone.
[b] Pressure criteria apply only at service connections.

### 6.2.2 Fire-flow Requirements

In addition to providing adequate water supply and pressure to serve residential, commercial, and industrial water demands placed on the system, the water system must also deliver an adequate supply for firefighting. Since fires can occur at any time, the water system must be ready to provide the required flow at all times with an adequate residual pressure. The water system should be capable of providing the fire flows during an MDD period (MDD+FF), which represents the day of the year having the highest water demands.

To determine the system's capacity to provide adequate fire flows, it was necessary to establish minimum fire-flow demand requirements to be applied to various locations throughout the distribution system, as well as a minimum residual pressure (the pressure near the flowing hydrant) and system pressure. The fire-flow requirements for the Sisquoc System service area were established in consultation with several sources: the Uniform Fire Code, California Fire Code, National Fire Protection Association, AWWA, the local fire authority (Santa Barbara County), and GSWC staff. This was used as a guide to develop the fire-flow criteria established for this master plan, which were presented in the previous section in TABLE 5-3.

## 6.3 Existing System Hydraulic Analysis

Several hydraulic computer model simulations were conducted for the existing distribution system to identify system and operational deficiencies, and to evaluate system improvements to mitigate these deficiencies. If more than one alternative was possible to mitigate a deficiency, the most cost-effective and constructible improvement was recommended.

### 6.3.1 Operational Assumptions

GSWC operations staff provided information on how the Sisquoc System would normally be operated under ADD, MDD, and PHD periods. Based on this information, the facilities available for the hydraulic analysis of the existing system are presented in TABLE 6-2. (Note: The status of wells, MWD connections, booster pumps and storage tanks were not based on the model results, but on the amount of supply needed for each demand period. For ADD, there is flexibility to operate various combinations of wells, as not all of the wells need to be operational to achieve the desired pressures; for MDD and PHD scenarios, firm capacity must be used.)

TABLE 6-2 Existing System Operating Facility Status

| Facility Name | ADD | MDD | PHD |
|---|---|---|---|
| **Wells—Main Zone** | | | |
| Foxen Canyon #4 | Available | Off | Off |
| Foxen Canyon #5 | Available | On | On |
| **Storage tanks** | | | |
| Sisquoc Reservoir 1 | 75% | 75% | 75% |
| Sisquoc Reservoir 2 | 75% | 75% | 75% |

### 6.3.2 Average Day Scenario Analysis

To analyze the average day scenario for the existing system, simulations were performed using the computer model with ADD. The demands were distributed in the model per TABLE 5-4, for a total demand of approximately 30 gpm. Only the facilities listed as 'Available' in TABLE 6-2 were used for ADD. (Note: Storage should not be drawn down for this planning scenario.) The modeling results were compared to the criteria identified in TABLE 6-1, and are discussed in Subsection 6.3.6.

### 6.3.3 Maximum Day Scenario Analysis

To analyze the maximum day scenario for the existing system, simulations were performed using the computer model with MDD. The demands were distributed in the model per TABLE 5-4, for a total demand of approximately 77 gpm. Only the facilities listed as 'On' in TABLE 6-2 were used for MDD. (Note: Storage should not be drawn down for this planning scenario.) The modeling results were compared to the criteria identified in TABLE 6-1, and are discussed in Subsection 6.3.6.

### 6.3.4 Peak Hour Scenario Analysis

To analyze the peak hour scenario for the existing system, simulations were performed using the computer model with PHD. The demands were distributed in the model per TABLE 5-4, for a total demand of approximately 115 gpm. Only the facilities listed as 'On' in TABLE 6-2 were used for PHD. (Note: Storage may be drawn down for this planning scenario.) The modeling results were compared to the criteria identified in TABLE 6-1, and are discussed in Subsection 6.3.6.

### 6.3.5 Fire-flow Scenario Analysis

For this master plan revision, the fire flow scenario was not analyzed.

### 6.3.6 Analysis Results and Recommended Improvements for the Existing System

Various alternatives were considered to correct the hydraulic deficiencies identified in the hydraulic analysis. The proposed improvements were evaluated for their ability to correct the deficiency and for their cost-effectiveness as compared to other alternatives.

#### Steady-State Deficiencies

The deficiencies identified in the ADD, MDD, and PHD simulations for the existing system are presented in TABLE 6-3 (Note: This table also includes any existing system improvements for supply and storage from Section 5). These deficiencies were analyzed in detail using the computer model by adding proposed improvements, reviewing the updated results, and repeating this process until acceptable results were obtained.

The distribution system was analyzed to identify areas of the system that experienced pressures below 40 psi or above 125 psi (criteria identified in TABLE 6-1). Various steady-state planning scenarios were used to analyze system pressures under different demand conditions to verify adequate system pressures. Where low pressures were observed during the analysis, one or more approaches were used to mitigate the low-pressure problem. In some cases, low pressures can be corrected with no physical improvement, such as by increasing the pressure setting of an upstream pressure regulating valve. However, sometimes substantial improvements may be required. Improvements may include replacing older pipelines with larger diameter pipelines to reduce friction losses, constructing new pump stations or pressure regulating stations, or modifying the boundaries of an existing pressure zone.

High velocities in water pipelines can also be an indication of an operational deficiency, and can lead to scouring of the pipe lining material or increase the chances of a valve failure. Increased velocities contribute to increased head loss, usually resulting in a less efficient water distribution system. Higher velocities may be acceptable for short-term operation, such as when needed for fire-flow, but otherwise should be lower where practical. The planning scenarios used to analyze the Sisquoc System for pressure deficiencies were also used to evaluate the velocities under the same demand periods (ADD, MDD, and PHD). The velocity criteria used to evaluate the distribution system for each demand period were defined in TABLE 6-1.

As stated in footnote 'a' of TABLE 6-1, "If velocity or headloss in a pipeline exceeded the criteria listed but did not result in low pressures in the system, the pipeline was not recommended for replacement." Thus, pipelines with velocities above the criteria identified in TABLE 6-1 but below 10 fps were reviewed for excessive pressure loss resulting in low pressures or excessive energy use. Where the velocities did not appear to contribute to pressure problems or excessive pumping, then no deficiency was identified and no improvement was proposed.

The numbering system used in deficiency tables below is a series of three numbers. The first number indicates the planning period: 1 for the existing system and 2 for the 2035 system. The second number indicates the deficiency number, which starts at 1 and increases by 1 for each deficiency identified. The third number identifies the improvement alternative (zero is reserved for the deficiency identification). Proposed improvements to correct the deficiency are numbered starting at 1. Therefore, the alternative number 1.2.3 would be used to identify the third proposed alternative for the second deficiency in the existing system. (Note: Deficiencies identified may not start with the number 1.1.0 if there are deficiencies identified in a prior section of this master plan.)

TABLE 6-3 Existing System Deficiencies and Recommend Improvements for ADD, MDD, and PHD

| Deficiency/ Alternative Number | Location | Deficiency | Recommended Improvement |
|---|---|---|---|
| - | - | - | - |

SECTION 7

# Water Quality Evaluation

The purpose of this section is to provide documentation of GSWC's water quality assessment effort for the Sisquoc System. Water quality of local groundwater and imported water were evaluated based on current federal and state standards and rules.

## 7.1 Current Status of Drinking Water Quality

The Sisquoc System is supplied by two active wells: Foxen Canyon Well #4 and Foxen Canyon Well #5. The water from each well is injected with 12.5 percent liquid sodium hypochlorite to provide a disinfectant residual in the water entering the distribution system. To comply with new permitting regulations, an additional source of supply will need to be put into place.

The drinking water quality of the Sisquoc System must comply with the Safe Drinking Water Act (SDWA), which is composed of primary and secondary drinking water standards. Compliance with primary drinking water standards is regulated by the U.S. Environmental Protection Agency (EPA). Compliance with both primary and secondary standards is required by the State Water Resources Control Board Division of Drinking Water (DDW).

Water quality sampling is performed at the source and within the distribution system to ensure compliance with regulatory standards. Sources are sampled as prescribed in Title 22 of the California Code of Regulations. Monitored constituents include general mineral, general physical, inorganic, volatile organic, synthetic organic, and radiological chemicals. The frequency of monitoring is dependent upon the parameter tested and the concentration of the constituent in the source water. Monitoring frequencies range from weekly to once every 9 years. The parameters monitored include specific constituents of concern (that is, if treatment is provided then the constituent being treated for would be tested), coliform bacteria, heterotrophic plate counts (HPCs), and chlorine residual. The distribution system is tested regularly for coliform bacteria, chlorine residual, general physical parameters, and disinfection by-products (trihalomethanes [TTHM] and haloacetic acids [HAA5]). The distribution system is tested weekly for the presence of coliform bacteria at one representative location in the system, and this site also undergoes further tests for color, odor and turbidity. Collection of disinfection by-product samples is performed on an annual basis.

## 7.2 Imported Water Quality

The Sisquoc System has no interconnections; therefore, this system does not import water.

## 7.3 Groundwater Quality

The Sisquoc System's active groundwater sources currently comply with all primary and secondary MCLs.

## 7.4 Water Quality Evaluation

The following discussion provides information on the relevant water quality evaluation rules for the Sisquoc System, including:

- Manganese
- Iron
- Per- and Polyfluoralkyl Substances

### 7.4.1 Manganese

Manganese occurs naturally in the environment in rocks and soil and is widely used in industrial and manufacturing processes. Levels of manganese above the Secondary Maximum Contaminant Level (SMCL) of 0.05 mg/L may lead to discolored grey to blackish water and staining of household fixtures. Legacy or historical manganese oxide deposits can accumulate overtime as a scale in water mains. If this scale becomes unstable, manganese oxide minerals can cause grey to black discolored water in the distribution system and customer's water pipes.

It is recognized in professional literature that the SMCL of 0.05 mg/L is too high to prevent discolored water events from manganese. Discolored water events due to mobilized legacy Manganese or dissolved manganese in bulk water can occur at concentrations generally above 20 ug/L (*Legacy of Manganese Accumulation in Water Systems*, Brandhuber et. al., Water Research Foundation Report #4314, pages 7 and 31, 2015). Therefore, Golden State Water is targeting a finished water manganese concentration of 20 ug/L instead of the SMCL of 50 ug/L as protective against aesthetic water quality issues associated with manganese.

Water produced from Foxen Canyon Well #4 is monitored for manganese on a monthly basis. The well has historically exceeded the target manganese value of 20 ug/L on several occasions. The average manganese value between 2015 and 2019 for Foxen Cayon Well #4 is 8.3 ug/L. This is below the target concentration of 20 ug/L, but there were a total of five months between 2015 and 2019 where the well was sampled above the target for GSWC. One sample exceeded the SMCL at a value of 67 ug/L.

### 7.4.2 Iron

Iron occurs naturally in the environment in rocks and soil and is widely used in industrial and manufacturing processes. For example, water mains are commonly constructed of various types of iron, with newer water mains containing a cement lining to prevent oxidation of the iron pipe into iron oxide (rust). Levels of iron above the SMCL of 0.3 mg/L may lead to discolored reddish water, staining of household fixtures, cause a metallic taste, and may result scale (mineral deposition) build up on the inside of hot water pipes and boilers. Legacy or historical iron oxide deposits can accumulate overtime in unlined iron water mains or as scale deposits on cement lined water mains.

Monthly samples indicated that water produced from Foxen Canyon Well #4 averages 190 ug/L in iron. This is below the SMCL of 300 ug/L.

### 7.4.3 Per- and Polyfluoroalkyl Substances

Per- and polyfluoroalkyl substances (PFAS) are a varied and sundry group of compounds used in a variety of industrial and commercial applications including fire-fighting foams, clothing, metal plating, and upholstery.

As a small public water system, the Sisquoc System's wells were not required to be monitored for PFAS including PFOA and PFOS as a part of the third unregulated contaminant monitoring rule (UCMR3).

The following outlines regulatory requirements for PFAS:

- In 2015, the EPA released a health advisory for two PFAS compounds, perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA), at a combined total of 70 nanograms per liter (ng/L).
- In July 2018, DDW set a notification level for PFOS of 13 ng/L and PFOA of 14 ng/L with a recommendation for source treatment or removal from service at a combined 70 ng/L. In the absence of a federal MCL, several states are in the process of developing MCL for PFAS.
- In March 2019, DDW issued the first phase of mandatory PFAS testing orders for public water systems across California based on proximity to: airports with fire training/response sites and previous PFOA/PFOS detections. The Sisquoc water system did not receive a mandatory testing order in the first phase.
- In August 2019, DDW revised the notification levels from 13 ng/L to 6.5 ng/L for PFOS and from 14 ng/L to 5.1 ng/L to PFOA.

The regulatory requirements for PFAS are expected to develop over the next one to three years. Regulations for this emerging contaminant will be closely monitored by Golden State Water.

## 7.5 Recommended Improvements

The water quality concerns that were discussed in the previous sections are summarized in TABLE 7-1.

TABLE 7-1 Recommended Improvements to Address Water Quality Concerns

| Alternative Number | Alternative Description |
|---|---|
| **1.3.0** | **Monitor Chlorine Residual at Wells** |
| 1.3.1 | Install chlorine residual monitors at all wells that do not currently have them and tie into the SCADA system. |

SECTION 8

# System Condition Assessment

The purpose of this section is to provide documentation of GSWC's system condition assessment effort for the Sisquoc System. This section is organized as follows:

- Previous system condition assessment efforts
- Updated condition assessments

## 8.1 Previous System Condition Assessment Efforts

More than 10 years ago, GSWC conducted several facility condition assessment efforts, working with multiple engineering consulting companies to develop a complete condition assessment for each of the Company's systems. Facilities in the Sisquoc System were addressed in this effort.

Generally, the purpose of these studies was to inspect and evaluate existing facilities to determine if upgrades would produce significant benefit to offset expenditures. These studies included the following information:

- Evaluations of the safety of the facilities
- Outstanding code violations
- A general evaluation of condition and reliability

## 8.2 Updated Condition Assessments

For this Master Plan, GSWC Operations and Planning personnel reviewed the condition of plant facilities and pipeline data within the Sisquoc System in order to identify the facilities requiring upgrade or replacement. For the pipeline conditional assessments, no specific recommendations were made based solely on condition, but age and material were considered along with pipeline leaks/breaks and input from operations staff.

### 8.2.1 Facility Condition Review

The purpose of this review was to identify plant improvement projects based on the following:

- Operational needs and requests
- Common items that are not installed at all plant sites
- Recommendations from the previous condition assessments that were not installed

GSWC reviewed each of the following elements to identify potential recommended improvements at each facility:

- Electrical
- Mechanical
- Structural
- Other site improvements

TABLE 8-1 summarizes the recommendations that were developed as a result of the system condition assessment review.

TABLE 8-1 2016 Condition Assessment Plant Projects

| Alternative Number | Facility | Project Description | Reason | Priority Category |
|---|---|---|---|---|
| 1.4.0 | Systemwide, SCADA System | Replace existing system with GSWC-standard system | Migrate to system platform | Short-term |

### 8.2.2 Pipeline Condition Review

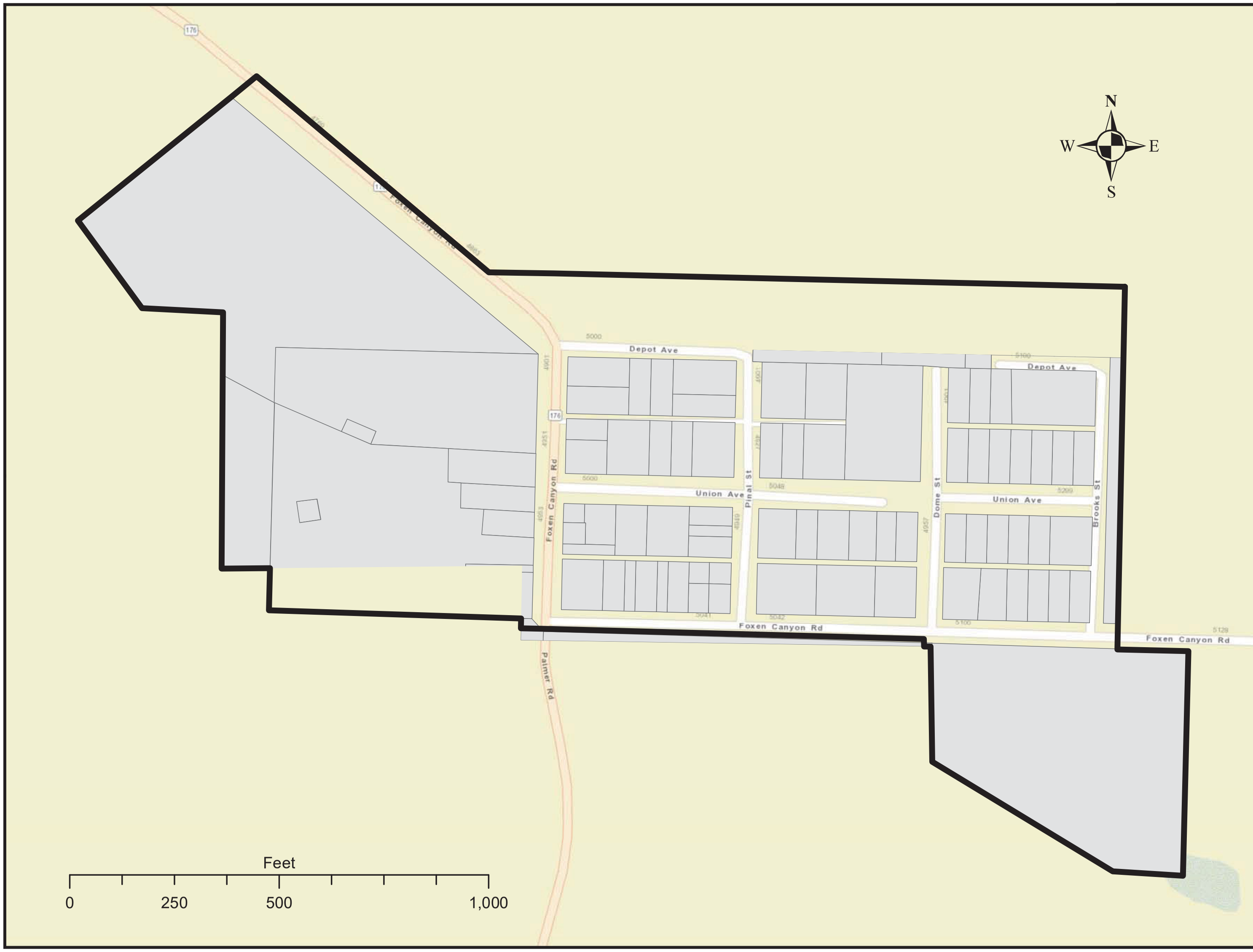
In addition to facility condition, GSWC monitors distribution system condition through the tracking of pipeline leaks/breaks on an annual basis; FIGURE 8-1 is a map of the leaks in the Sisquoc System from 2014 to 2018. This information was used, along with additional risk assessment analysis, to make recommendations regarding potential CIP projects and in the prioritization of those projects. (See GSWC's *Pipeline Management Program Report* and *Risk Based Asset Management Program Report*.)

TABLE 8-2 2016 Condition Assessment Pipeline Projects

| Alternative Number | Recommended Improvement | Reason | Priority Category |
|---|---|---|---|
| 2.1.0 | Install main from Depot Ave to Dome St, Approximately 100 LF of 8-inch PVC (or Depot Ave to Pinal St, Approximately 550 LF) | Loop dead ends (easements needed) | Long-term |

# Figures

# SISQUOC SYSTEM LEAK MAP 2014 - 2018




**Year & Number of Leaks**

- 2014 - 0 Leaks
- 2015 - 0 Leaks
- 2016 - 0 Leaks
- 2017 - 0 Leaks
- 2018 - 0 Leaks

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Last Update: 1/14/2019

SECTION 9

# Capital Improvement Program

The capital improvement program (CIP) is an essential component of this water master plan. The CIP summarizes recommended facilities, and establishes the priority and timing of necessary improvements. The recommended improvements were analyzed and evaluated in the previous sections of this report.

The recommended improvements were prioritized into two categories—short-term (existing system) or long-term (2040 system)—to identify when these improvements are required. The project selection and prioritization process considered various issues, including existing deficiencies, projected demands, water quality, regulatory compliance, reliability and facility condition.

## 9.1 Cost Estimation

No cost estimates are included in this master plan, as the final costs of a project, and the project's resulting feasibility, will depend on actual labor and material costs, inflation, competitive market conditions, actual site conditions, final project scope, implementation schedule, continuity of personnel and engineering, and other variable factors. Prior to design and construction of any recommended project in this master plan, a detailed project cost estimate will be created.

## 9.2 Project Prioritization

The following descriptions define how projects were prioritized into one of the two categories:

- **Short-term improvement projects** were based on deficiencies identified in the existing system. Deficiencies included supply and storage, hydraulic, condition assessment, and water quality. Operational improvements were included as a short-term improvement only when a significant short-term benefit was identified.
- **Long-term improvement projects** are based on deficiencies identified beyond the short-term planning years through the year 2040. The water system was assumed to be built out by the year 2040. The long-term improvements are typically projects necessary to meet future demands and replace or rehabilitate aging infrastructure.

## 9.3 CIP Projects

TABLE 9-1 lists the recommended improvements for the Sisquoc System. Each project is assigned a unique identification number and a priority: short-term or long-term. Short-term pipeline projects are shown on FIGURE 9-1.

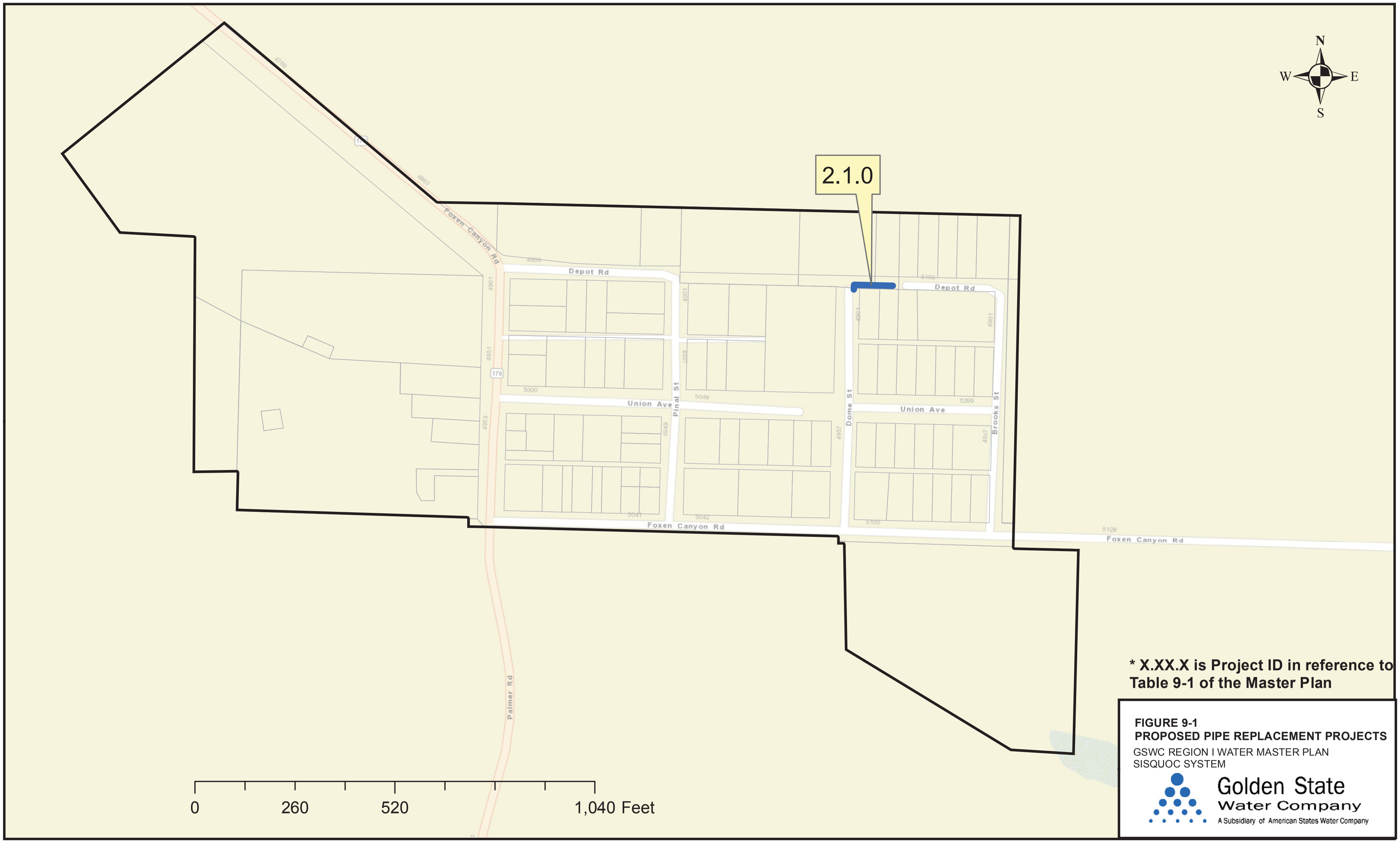
TABLE 9-1 Summary of Recommend CIP Projects

| Project ID | Recommended Improvement | Improvement Type | Priority Category |
|---|---|---|---|
| 1.1.1 | Construct 0.20 MG reservoir and access road | Storage | Short-term |
| 1.3.1 | Install chlorine residual monitors at all wells that do not currently have them and tie into the SCADA system | Water Quality | Short-term |
| 1.4.0 | Replace existing SCADA system with GSWC-standard system | Conditional Assessment | Short-term |
| 2.1.0 | Acquire easements in order to install main from Depot Ave to Dome/Pinal St | Conditional Assessment | Long-term |

# 9.4 Additional Considerations

N/A

# Figures




* X.XX.X is Project ID in reference to Table 9-1 of the Master Plan

**FIGURE 9-1**
**PROPOSED PIPE REPLACEMENT PROJECTS**
GSWC REGION I WATER MASTER PLAN
SISQUOC SYSTEM

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*Last Update: 12/12/2019*

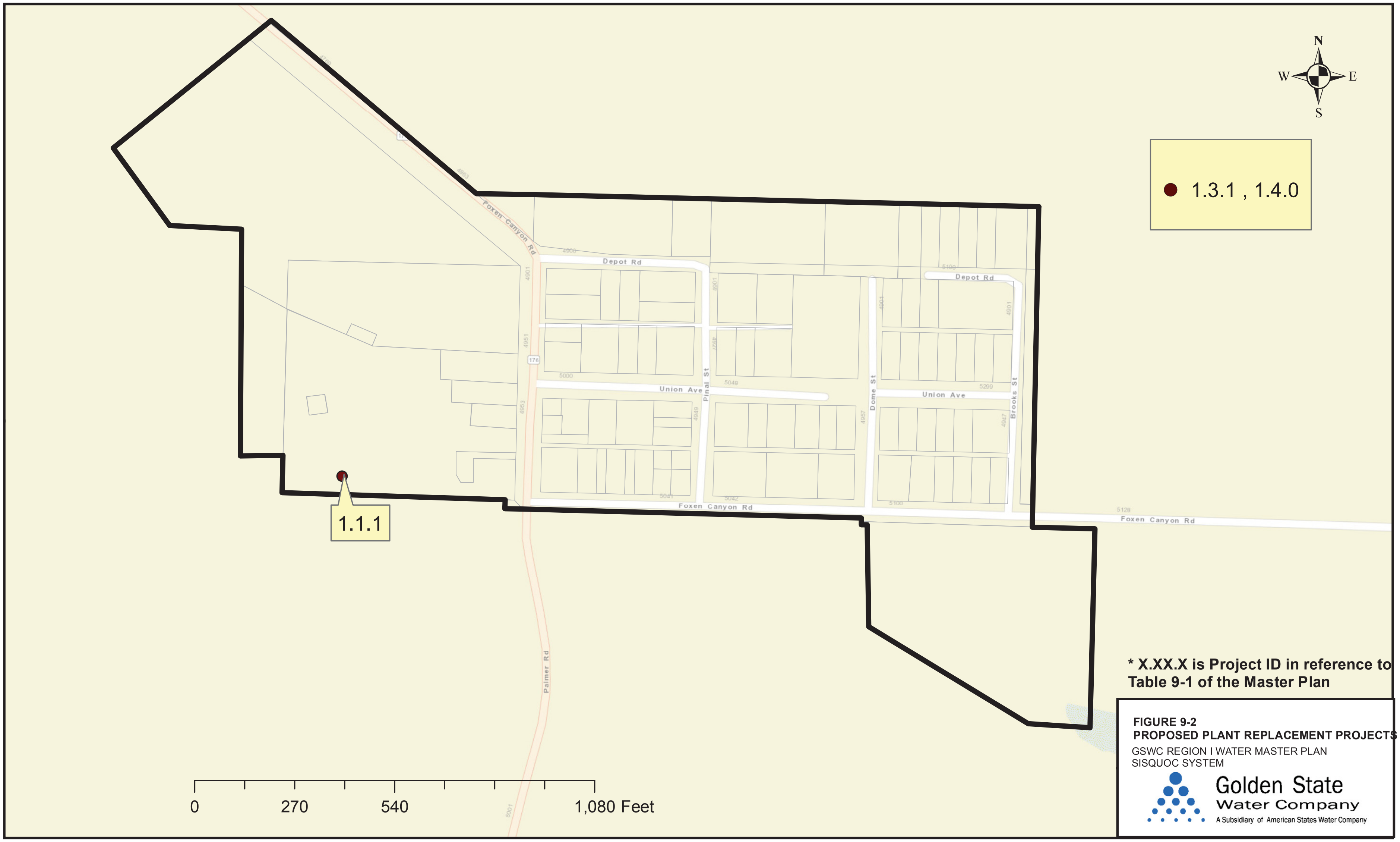


**FIGURE 9-2**
**PROPOSED PLANT REPLACEMENT PROJECTS**
GSWC REGION I WATER MASTER PLAN
SISQUOC SYSTEM

*Last Update: 12/18/2019*

SECTION 10

# References


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